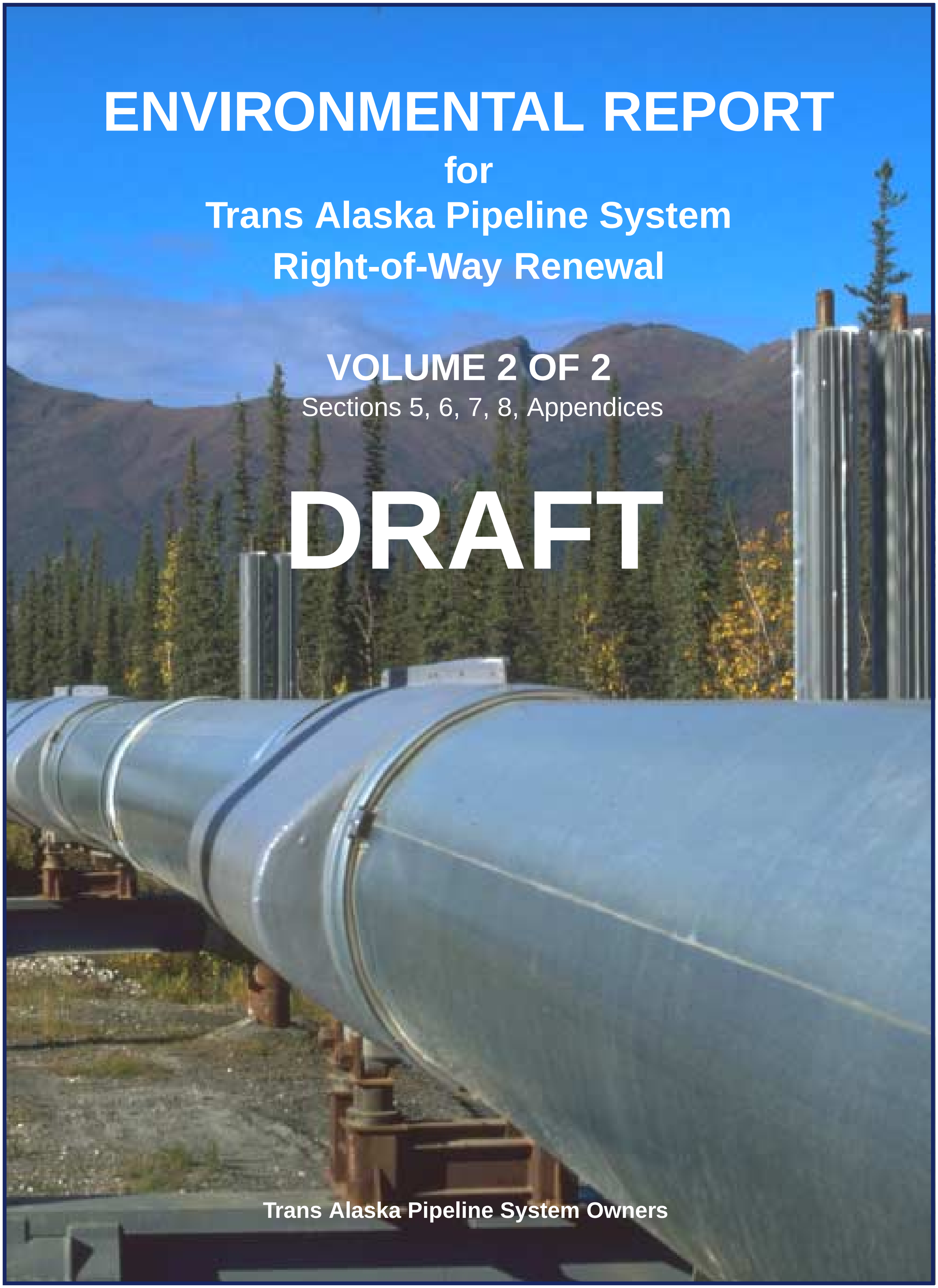
State and Federal Applications for Renewal of the Trans Alaska Pipeline System

Notice on Revisions

The contents of this electronic file are subject to revision without notice to individual holders. However, revisions will be placed on the TAPS Right-of-Way Renewal web site at www.tapsrow.com. Please visit the web site to ensure that you have the current version.



ENVIRONMENTAL REPORT

for

Trans Alaska Pipeline System Right-of-Way Renewal

VOLUME 2 OF 2

Sections 5, 6, 7, 8, Appendices

DRAFT

Trans Alaska Pipeline System Owners

ENVIRONMENTAL REPORT

for

Trans Alaska Pipeline System

Right-of-Way Renewal

Volume 2 of 2

Sections 5, 6, 7, 8, Appendices

DRAFT

Trans Alaska Pipeline System Owners

ENVIRONMENTAL REPORT FOR TRANS ALASKA PIPELINE SYSTEM RENEWAL

IMPORTANT NOTE

The authors of this Environmental Report have made every effort to gather complete and accurate data for their analysis. Projections of future TAPS throughput and configuration, North Slope oil development, gas commercialization and tanker transportation are necessarily dependent on assumptions about oil and gas production, future technology, and the facilities and equipment needed. The authors' assumptions represent informed projections based on knowledge of current operations and are not meant to imply that these predictions completely and accurately reflect all future scenarios pertaining to TAPS, North Slope oil and gas development, or tanker transportation. Actual outcomes are dependant on many variables including the economics of oil and gas production, changing laws and regulations, and political realities, and may differ significantly from those predicted here.

SECTION 5

LIST OF PREPARERS

AUTHOR	SECTION OF ENVIRONMENTAL REPORT	AFFILIATION
Alaska Biological Research staff	4.5.3.2, 4.5.4.2	ABR, Inc. - Environmental Research & Services
Anderson, Betty, MS	3.2.4, 4.3.2.4, 4.4.2.4	ABR, Inc. - Environmental Research & Services
Ballard, Warren, Ph.D.	3.2.5, 4.3.2.5, 4.4.2.5, 4.5.3.2, *Proposed Action: Terrestrial Mammals (4.5.3.2)*, 4.5.4.2, *No Action: Terrestrial Mammals* (4.5.4.2)	Range, Wildlife and Fisheries Management
Brown, Anne	Project management	Levenson Brown Consulting
Bowers, Peter, MA, RPA	3.3.2, 3.3.3, 3.3.4, 4.3.3.2, 4.3.3.3, 4.3.3.4, 4.4.3.2, 4.4.3.3, 4.4.3.4, 4.5.3.3, 4.5.4.3, 4.8	Northern Land Use Research, Inc.
Burgess, William, Ph.D.	3.2.5, 4.3.2.5, 4.4.2.5	Greeneridge Services, Inc.
Burns, John, Ph.D.	3.2.6, *Proposed Action: Marine Mammals* (4.5.3.2)	University of Alaska, Fairbanks
Clifton, Lois	1.3, document editing	Lukin Publications Management
Clearwater Environmental, Inc. staff	3.3.5, 3.3.6, 3.3.7, 3.3.8, 4.3.3.5, 4.3.3.6, 4.3.3.7, 4.3.3.8, 4.3.3.9, 4.3.3.10, 4.3.3.11, 4.4.3.5, 4.4.3.6, 4.4.3.7, 4.4.3.8, 4.4.3.9, 4.4.3.10, 4.4.3.11, 4.11	Clearwater Environmental, Inc.
Colonell, Joseph, Ph.D.	4.5.4.1	URS Alaska Operations
Cronin, Matt, Ph.D.	3.2.5, 4.2.1.7, 4.3.2.5, 4.4.2.5, 4.5.3.2, *Proposed Action: Terrestrial Mammals (4.5.3.2), Proposed Action: Birds (4.5.3.2), Proposed Action: Threatened and Endangered Species (4.5.3.2),* 4.5.4.2, *No Action: Terrestrial Mammals* (4.5.4.2), *No Action: Marine Mammals* (4.5.4.2), *No Action: Threatened and Endangered Species* (4.5.4.2)	LGL Alaska Research Associates, Inc.
Day, Robert, Ph.D.	3.2.4, 4.3.2.4, 4.4.2.4	ABR, Inc. - Environmental Research & Services

AUTHOR	SECTION OF ENVIRONMENTAL REPORT	AFFILIATION
Dugan, Robert, CPG	3.1.1, 4.2.1.1, *Slope Stability Monitoring* (4.2.2.1) , *Glacier Surge Monitoring* (4.2.2.1), 4.3.1.1, 4.3.1.4, 4.4.1.1	ABR, Inc. - Environmental Research & Services
Endell, Janna, P.E.	4.2.1.6	Alyeska Pipeline Service Co.
Fechhlem, Robert, Ph.D.	3.2.3, 4.3.2.3, 4.4.2.3, *Proposed Action: Fish* (4.5.3.2)	LGL Alaska Research Associates, Inc.
Funk, Dale, Ph.D.	3.2.2, 4.3.2.2, 4.4.2.2, 4.5.3.2, *Proposed Action: Vegetation and Wetlands* (4.5.3.2), 4.5.4.2, *No Action: Vegetation and Wetlands* (4.5.4.2), 4.12, 4.13	LGL Alaska Research Associates, Inc.
Galginaitis, Michael	3.3.2, 3.3.3, 4.3.3.2, 4.3.3.3, 4.4.3.2, 4.4.3.3, 4.5.3.3, 4.5.4.3, 4.8	Applied Sociocultural Research, Alaska
Galloway, Benny, Ph.D.	1.3, Appendix D	LGL Alaska Research Associates, Inc.
Gates, Virginia L., MS	3.1.2, 4.2.1.5, 4.3.1.2	Arctic Gates Consulting
Gerlach, S. Craig, Ph.D.	3.3.2, 3.3.3, 3.3.4, 4.3.3.2, 4.3.3.3, 4.3.3.4, 4.4.3.2, 4.4.3.3, 4.4.3.4, 4.5.3.3, 4.5.4.3, 4.8, Appendix D	Northern Land Use Research, Inc. University of Alaska Anchorage
Golder Associates staff	3.1.1, 4.3.1.1	Golder Associates
Goldsmith, Oliver S., Ph.D.	3.3.1, 4.3.3.1, 4.4.3.1, 4.5.3.3, 4.5.4.3, 4.8	University of Alaska, Anchorage
Gryder-Boutet, Donna	3.1.2, 4.3.1.2	The Boutet Company
Haas, Erik, MS, Dipl. Eng. (German P.E.)	3.1.3, 4.2.1.4, *Air Quality Monitoring* (4.2.2.3), 4.3.1.3, 4.4.1.3	HMH Technical Environmental Consulting
Haley, Beth	4.3.2.7, 4.12	LGL Alaska Research Associates, Inc.
Harle, Jim, P.E.	4.1.1, 4.2.2	
IT Corporation staff	4.1.2, Appendix B	IT Corporation
Jakubzak, Ray, Ph.D.	Project management	BP Exploration (Alaska), Inc.
Jokela, J. Brett, MS, P.E.	3.1.2, 4.2.1.5, *Water Quality Monitoring* (4.2.2.3), 4.3.1.2, 4.4.1.2	Montgomery Watson
Johnson, C.B., MS	3.2.6	ABR, Inc. - Environmental Research & Services
Johnson, Steve, Ph.D.	3.2.4, 3.2.6, 4.3.2.4, 4.4.2.4, 4.5.3.2, *Proposed Action: Birds* (4.5.3.2), *Proposed Action: Threatened and Endangered Species* (4.5.3.2), 4.5.4.2, *No Action: Birds* (4.5.4.2)	LGL, Canada
Jorgenson, M. Torre, MS	3.2.2, 4.3.2.2, 4.4.2.2, 4.13	ABR, Inc. - Environmental Research & Services
Kidd, Janet, MS	3.2.2, 3.2.7, 4.3.2.2, 4.3.2.6, 4.4.2.2, 4.4.2.6, 4.13	ABR, Inc. - Environmental Research & Services
Lawhead, Brian, MS	3.2.5, 4.3.2.5	ABR, Inc. - Environmental Research & Services.
LGL Alaska Research Associates, Inc. staff	4.5.3.2, 4.5.4.2	LGL Alaska Research Associates, Inc.
Loggie, Chipper	Project management	ExxonMobil
Lukin, James	4.2.3, document editing	Lukin Publications Management
Maxim, L. Daniel, Ph.D.	2.1.2, 3.3.1, 4.1.2, 4.2.4, 4.3.3.1, 4.4.3.1, 4.5.2, 4.5.3.3, 4.5.4.3, 4.6, 4.7, 4.8, 4.9, 4.10, Appendix A, Appendix B	Everest Consulting

AUTHOR	SECTION OF ENVIRONMENTAL REPORT	AFFILIATION
McKendrick, Jay, Ph.D.	3.2.1, 3.2.2, 4.3.2.1, 4.3.2.2, 4.4.2.1, 4.4.2.2, 4.12, 4.13	Lazy Mt. Research
Moulton, Larry, Ph.D.	3.2.3, 4.3.2.3, 4.4.2.3, 4.5.3.2, *Proposed Action: Fish,* (4.5.3.2)*,* 4.5.4.2*, No Action: Fish* (4.5.4.2)	MJM Research
Murphy, Stephen, MS	3.2.5, 4.3.2.5	ABR, Inc. - Environmental Research & Services
Niebo, Ron, MS	3.3.1, 4.1.2, 4.3.3.1, 4.4.3.1, 4.5.3.3, 4.5.4.3, 4.6, 4.8, Appendix B	Everest Consulting
Norton, Dave, P.E.	2.1.1, 2.2, 4.1.1, 4.2.1.6, 4.2.2, 4.5.3.1, 4.5.4.1	JD Norton Associates
Nyman, Douglas, Ph.D., P.E.	4.2.1.2, Seismic/Earthquake Monitoring (4.2.2.1), Seismicity (4.4.1.1)	D.J. Nyman & Associates
Potter, Ben, MA	3.3.4	Northern Land Use Research, Inc. University of Alaska Anchorage
Ritchie, Robert, MS	3.2.1, 3.2.4, 3.2.7, 4.3.2.1, 4.3.2.4, 4.3.2.6, 4.4.2.1, 4.4.2.4, 4.4.2.6	ABR, Inc. - Environmental Research & Services
Riordan, Joseph, P.E.	2.1.1, 2.2, 4.2.1.6	Energy Professionals LLC
Rubin, Ken, esq.	1.2	Morgan, Lewis, & Bockius LLC
Senner, Robert G.B., Ph.D.	4.5.1, 4.5.2, 4.5.3.1, 4.5.3.2, *Proposed Action: Marine Mammals* (4.5.3.2), *Proposed Action: Vegetation and Wetlands* (4.5.3.2), 4.5.4.1, 4.5.4.2, *No Action: Vegetation and Wetlands* (4.5.4.2), *No Action: Marine Mammals* (4.5.4.2), *No Action: Threatened and Endangered Species* (4.5.4.2), 4.5.5, 4.8	LGL Alaska Research Associates, Inc., Fairbanks
Trimm, Bryan, MS	4.5.3.1, 4.5.4.1	URS, Alaska Operations
Troy, Declan, MS	3.2.4, 3.2.7, 4.3.2.4, 4.3.2.6, 4.4.2.4, 4.4.2.6	TERA
Veldman, Wim, MS, P. Eng. (Canadian P.E.)	4.2.1.3, *Rivers and Floodplains* (4.2.2.1), *Rivers and Floodplains* (4.3.1.1), *Rivers and Floodplains* (4.4.1.1)	Hydroconsult
Whitlaw, Heather, MS	3.2.1, 3.2.5, 4.2.1.7, *Biological Considerations for Operations and Maintenance* (4.2.2.3), 4.3.2.1, 4.3.2.5, 4.4.2.1, 4.4.2.5, 4.5.3.2, *Proposed Action: Terrestrial Mammals (4.5.3.2),* 4.5.4.2, *No Action: Terrestrial Mammals* (4.5.4.2)	LGL Alaska Research Associates, Inc.
Wooley, Christopher, MA	3.3.2, 3.3.3, 3.3.4, 4.3.3.2, 4.3.3.3, 4.3.3.4, 4.4.3.2, 4.4.3.3, 4.4.3.4, 4.5.3.3, 4.5.4.3, 4.8	Chumis Cultural Research Services, Anchorage

SECTION 6

INDEX

SECTION 7

LIST OF ACRONYMS

AAAQS	Alaska Ambient Air Quality Standards
ACEC	Area of critical ecological concern
ADCED	Alaska Department of Community and Economic Development
ADDS Packs	Airborne Dispersant Delivery System Packages
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOR	Alaska Department of Revenue
ADOT	Alaska Department of Transportation
AEWC	Alaska Eskimo Whaling Commission
AGC 21	Advanced Gas Conversion for the 21st Century
AIMS	Alyeska Integrity Management System
AIS	Automatic Information System
ANCSA	Alaska Native Claims Settlement Act
ANGTS	Alaska Natural Gas Transportation System
ANILCA	Alaska National Interest Lands Conservation Act
ANS	Alaska North Slope
ANWR	Arctic National Wildlife Refuge
API	American Petroleum Institute
APSC	Alyeska Pipeline Service Company
AS	Alaska Statutes
ASNA	Arctic Slope Native Association
ASRC	Arctic Slope Regional Corporation
ATV	All-terrain vehicle
bbl	Barrel(s)
BLM	Bureau of Land Management (U.S. Department of Interior)
BMP	Best management practice
BOD	Biochemical oxygen demand
BTEX	Benzene, toluene, ethylbenzene, and xylene
BWTF	Ballast Water Treatment Facility
C	Centigrade
CAH	Central Arctic Herd (caribou)
CCMP	*Corrosion Control Management Plan* (Alyeska)
CCP	Central Compressor Plant
CDF	Cumulative distribution function
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CH_4	Methane
CITES	Convention on International Trade in Endangered Species
CKV	Check valve
cm	Centimeter(s)
CO	Carbon monoxide
CO_2	Carbon dioxide
COTU	Crude oil topping unit
CWA	Clean Water Act of 1972
CZMP	Coastal zone management plan
dB	Decibel(s)
DB	Design Basis

DBGC	Designated big game crossing
DCE	Design contingency earthquake
DCH	Delta Caribou Herd
DCUA	Delta Controlled Use Area
DEW	Distant Early Warning
DGPS	Differential global positioning system
DHC	Dalton Highway Corridor
DHCMA	Dalton Highway Corridor Management Area
DJBR	Delta Junction Bison Range
DLP	Defense of life and property
DOE	Design operating earthquake
DOI	U.S. Department of Interior
DR&R	Dismantlement, removal, and restoration
DRA	Drag reducing agent
DSMA	Digital strong motion accelerograph
E&P	Exploration and production
EA	Environmental assessment
ECDIS	Electronic Chart Display and Information System
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
ER	Environmental report
ESA	Endangered Species Act
EVOS	*Exxon Valdez* oil spill
F	Fahrenheit
FAA	Federal Aviation Administration
FEG	Field Environmental Generalist
FERC	Federal Energy Regulatory Commission
FNSB	Fairbanks North Star Borough
FR	Federal Register
FSB	Federal Subsistence Board
FT	Fischer Tropsch
ft	Foot or feet
FTE	Full-time equivalent
FWS	U.S. Fish and Wildlife Service
g	Gram(s)
GAO	U.S. General Accounting Office
GC 1	Gathering Center 1
GCM	General circulation models
GMU	Game management unit
GPS	Global positioning system
GRD	Geographical Resource Database
GSP	Gross state product
GTL	Gas to liquids
H_2S	Hydrogen sulfide
ha	Hectare(s)
ICAS	Inupiat Community of the Arctic Slope
in^3	Cubic inch(es)
IRA	Indian Reorganization Act of 1934
ISER	Institute of Social and Economic Research (University of Alaska)
ISO	International Organization for Standardization
IWC	International Whaling Commission
IWSS	Industrial wastewater sewer system
JPO	Joint Pipeline Office
K	Potassium
kg	Kilogram(s)
km	Kilometer(s)
km^2	Square kilometer(s)
l	Liter(s)
lb	Pound(s)
LNG	Liquefied natural gas
LVB	Line volume balance
m	Meter(s)
m^3	Cubic meter(s)
MAP	Man in the Arctic Program
MARAD	U.S. Maritime Administration
MCCF	Mobile construction contingency facility
MCF	Thousand cubic feet
mg	Milligram(s)
MLA	Mineral Leasing Act of 1920
MLU	Mainline unit
mm	Millimeter(s)
MMbp	Million barrels per day
MMgpd	Million gallons per day
MMPA	Marine Mammal Protection Act

MMS	U.S. Minerals Management Service
MOD	Money of the day
MP	Milepost
MSGP	Multi-Sector General Permit (National Pollutant Discharge Elimination System)
NAAQS	National Ambient Air Quality Standards
NARL	Naval Arctic Research Laboratory
NCH	Nelchina Caribou Herd
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMDS	National Missile Defense System
NMFS	National Marine Fisheries Service
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOAA	National Oceanographic and Atmospheric Administration
NO_X	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPR-A	National Petroleum Reserve - Alaska
NPRPA	National Petroleum Reserve Production Act of 1976
NRHP	National Register of Historic Places
NSB	North Slope Borough
NSPS	New Source Performance Standards
NWS	National Weather Service
O&M	Operation and maintenance
O_3	Ozone
OCC	Operations Control Center
OPA 90	Oil Pollution Act of 1990
OPS	Office of Pipeline Safety (U.S. Department of Transportation)
ORV	Off-road vehicle
P	Phosphorus
PAH	Polynuclear aromatic hydrocarbon
PCH	Porcupine Caribou Herd
PDF	Pipeline design flood
PET 4	Naval Petroleum Reserve Number 4
PFD	Permanent Fund dividend
PLQ	Permanent living quarters
PM-10	Particulate matter
PMP	Probable maximum precipitation
ppm	Part(s) per million
PS	Pump station
PSD	Prevention of significant deterioration
psig	Pounds per square inch gauge
PWS	Prince William Sound
PWSAC	Prince William Sound Aquaculture Corporation
RCAC	Regional Citizens' Advisory Council
RGV	Remote gate valve
RMH	Ray Mountains Herd (caribou)
ROW	Right-of-way
rpm	Revolutions per minute
RV	Recreational vehicle
SASMZ	Special areas and special management zones
SCADA	Supervisory control and data acquisition
SERVS	Ship Escort/Response Vessel System
SHPO	State Historic Preservation Office
SIC	Standard Industrial Code
SO_2	Sulfur dioxide
TAGS	Trans-Alaska Gas System
TAPAA	Trans Alaska Pipeline Authorization Act
TAPS	Trans Alaska Pipeline System
tcf	Trillion cubic feet
TES	Threatened and endangered species
TLH	Teshekpuk Lake Herd (caribou)
TSP	Total suspended particulates
TSS	Total suspended solids
TVB	Transient volume balance
UAA	University of Alaska Anchorage
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDOE	U.S. Department of Energy
USGS	U.S. Geological Survey

VHF	Very high frequency
VMT	Valdez Marine Terminal
VOC	Volatile organic compound
VSM	Vertical support member
VTS	Vessel Traffic Service
WAH	Western Arctic Herd (caribou)
WAMCATS	Washington/Alaska Military Cable and Telegraph System
WMH	White Mountains Herd (caribou)
WSR	Wild and scenic river
ZRA	Zone of restricted activity
m	Micrometers
mg	Micrograms

SECTION 7

LIST OF ACRONYMS

AAAQS	Alaska Ambient Air Quality Standards
ACEC	Area of critical ecological concern
ADCED	Alaska Department of Community and Economic Development
ADDS Packs	Airborne Dispersant Delivery System Packages
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOR	Alaska Department of Revenue
ADOT	Alaska Department of Transportation
AEWC	Alaska Eskimo Whaling Commission
AGC 21	Advanced Gas Conversion for the 21st Century
AIMS	Alyeska Integrity Management System
AIS	Automatic Information System
ANCSA	Alaska Native Claims Settlement Act
ANGTS	Alaska Natural Gas Transportation System
ANILCA	Alaska National Interest Lands Conservation Act
ANS	Alaska North Slope
ANWR	Arctic National Wildlife Refuge
API	American Petroleum Institute
APSC	Alyeska Pipeline Service Company
AS	Alaska Statutes
ASNA	Arctic Slope Native Association
ASRC	Arctic Slope Regional Corporation
ATV	All-terrain vehicle
bbl	Barrel(s)
BLM	Bureau of Land Management (U.S. Department of Interior)
BMP	Best management practice
BOD	Biochemical oxygen demand
BTEX	Benzene, toluene, ethylbenzene, and xylene
BWTF	Ballast Water Treatment Facility
C	Centigrade
CAH	Central Arctic Herd (caribou)
CCMP	*Corrosion Control Management Plan* (Alyeska)
CCP	Central Compressor Plant
CDF	Cumulative distribution function
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CH_4	Methane
CITES	Convention on International Trade in Endangered Species
CKV	Check valve
cm	Centimeter(s)
CO	Carbon monoxide
CO_2	Carbon dioxide
COTU	Crude oil topping unit
CWA	Clean Water Act of 1972
CZMP	Coastal zone management plan
dB	Decibel(s)
DB	Design Basis

DBGC	Designated big game crossing
DCE	Design contingency earthquake
DCH	Delta Caribou Herd
DCUA	Delta Controlled Use Area
DEW	Distant Early Warning
DGPS	Differential global positioning system
DHC	Dalton Highway Corridor
DHCMA	Dalton Highway Corridor Management Area
DJBR	Delta Junction Bison Range
DLP	Defense of life and property
DOE	Design operating earthquake
DOI	U.S. Department of Interior
DR&R	Dismantlement, removal, and restoration
DRA	Drag reducing agent
DSMA	Digital strong motion accelerograph
E&P	Exploration and production
EA	Environmental assessment
ECDIS	Electronic Chart Display and Information System
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
ER	Environmental report
ESA	Endangered Species Act
EVOS	*Exxon Valdez* oil spill
F	Fahrenheit
FAA	Federal Aviation Administration
FEG	Field Environmental Generalist
FERC	Federal Energy Regulatory Commission
FNSB	Fairbanks North Star Borough
FR	Federal Register
FSB	Federal Subsistence Board
FT	Fischer Tropsch
ft	Foot or feet
FTE	Full-time equivalent
FWS	U.S. Fish and Wildlife Service
g	Gram(s)
GAO	U.S. General Accounting Office
GC 1	Gathering Center 1
GCM	General circulation models
GMU	Game management unit
GPS	Global positioning system
GRD	Geographical Resource Database
GSP	Gross state product
GTL	Gas to liquids
H_2S	Hydrogen sulfide
ha	Hectare(s)
ICAS	Inupiat Community of the Arctic Slope
in^3	Cubic inch(es)
IRA	Indian Reorganization Act of 1934
ISER	Institute of Social and Economic Research (University of Alaska)
ISO	International Organization for Standardization
IWC	International Whaling Commission
IWSS	Industrial wastewater sewer system
JPO	Joint Pipeline Office
K	Potassium
kg	Kilogram(s)
km	Kilometer(s)
km^2	Square kilometer(s)
l	Liter(s)
lb	Pound(s)
LNG	Liquefied natural gas
LVB	Line volume balance
m	Meter(s)
m^3	Cubic meter(s)
MAP	Man in the Arctic Program
MARAD	U.S. Maritime Administration
MCCF	Mobile construction contingency facility
MCF	Thousand cubic feet
mg	Milligram(s)
MLA	Mineral Leasing Act of 1920
MLU	Mainline unit
mm	Millimeter(s)
MMbp	Million barrels per day
MMgpd	Million gallons per day
MMPA	Marine Mammal Protection Act

MMS	U.S. Minerals Management Service
MOD	Money of the day
MP	Milepost
MSGP	Multi-Sector General Permit (National Pollutant Discharge Elimination System)
NAAQS	National Ambient Air Quality Standards
NARL	Naval Arctic Research Laboratory
NCH	Nelchina Caribou Herd
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMDS	National Missile Defense System
NMFS	National Marine Fisheries Service
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOAA	National Oceanographic and Atmospheric Administration
NO_X	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPR-A	National Petroleum Reserve - Alaska
NPRPA	National Petroleum Reserve Production Act of 1976
NRHP	National Register of Historic Places
NSB	North Slope Borough
NSPS	New Source Performance Standards
NWS	National Weather Service
O&M	Operation and maintenance
O_3	Ozone
OCC	Operations Control Center
OPA 90	Oil Pollution Act of 1990
OPS	Office of Pipeline Safety (U.S. Department of Transportation)
ORV	Off-road vehicle
P	Phosphorus
PAH	Polynuclear aromatic hydrocarbon
PCH	Porcupine Caribou Herd
PDF	Pipeline design flood
PET 4	Naval Petroleum Reserve Number 4
PFD	Permanent Fund dividend
PLQ	Permanent living quarters
PM-10	Particulate matter
PMP	Probable maximum precipitation
ppm	Part(s) per million
PS	Pump station
PSD	Prevention of significant deterioration
psig	Pounds per square inch gauge
PWS	Prince William Sound
PWSAC	Prince William Sound Aquaculture Corporation
RCAC	Regional Citizens' Advisory Council
RGV	Remote gate valve
RMH	Ray Mountains Herd (caribou)
ROW	Right-of-way
rpm	Revolutions per minute
RV	Recreational vehicle
SASMZ	Special areas and special management zones
SCADA	Supervisory control and data acquisition
SERVS	Ship Escort/Response Vessel System
SHPO	State Historic Preservation Office
SIC	Standard Industrial Code
SO_2	Sulfur dioxide
TAGS	Trans-Alaska Gas System
TAPAA	Trans Alaska Pipeline Authorization Act
TAPS	Trans Alaska Pipeline System
tcf	Trillion cubic feet
TES	Threatened and endangered species
TLH	Teshekpuk Lake Herd (caribou)
TSP	Total suspended particulates
TSS	Total suspended solids
TVB	Transient volume balance
UAA	University of Alaska Anchorage
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDOE	U.S. Department of Energy
USGS	U.S. Geological Survey

VHF	Very high frequency
VMT	Valdez Marine Terminal
VOC	Volatile organic compound
VSM	Vertical support member
VTS	Vessel Traffic Service
WAH	Western Arctic Herd (caribou)
WAMCATS	Washington/Alaska Military Cable and Telegraph System
WMH	White Mountains Herd (caribou)
WSR	Wild and scenic river
ZRA	Zone of restricted activity
m	Micrometers
mg	Micrograms

SECTION 8

LITERATURE CITED

Abbot, S.M. (ed.). 1992. Caribou. Management Report of Survey-Inventory Activities. 1 July 1989-30 June 1991. Federal Aid in Wildlife Restoration, Projects W-23-3 and W-23-4, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Abbot, S.M. (ed.). 1993. Caribou. Management Report of Survey-Inventory Activities. 1 July 1990-30 June 1992. Federal Aid in Wildlife Restoration, Projects W-23-5 and W-24-1, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Abrahamson, J.D. 1968. Westward Alaska: The Native Economy and Its Resource Base. Federal Field Committee for Development Planning in Alaska, Anchorage, Alaska.

ACCRA. 1999. ACCRA Inter-city Cost of Living Index. American Chamber of Commerce Research Association.

Adams, L.G. 1988. Dall Sheep Survey, Gates of the Arctic National Park and Preserve, Alaska – 1987. Natural Resources Survey and Inventory Report, AR-88/15. National Park Service, Anchorage, Alaska.

Adams, L.G., and J.A. Bailey. 1982. Population Dynamics of Mountain Goats in the Sawatch Range, Colorado. *Journal of Wildlife Management*, 46:1003-1009.

Adams, P.C. 1999. The Dynamics of White Spruce Populations on a Boreal River Floodplain. Ph.D. dissertation, Duke University, Durham, North Carolina.

Adams, P.C., and L.A. Viereck. 1992. Multivariate Analysis of Woody Plant Succession on the Tanana River in Interior Alaska. *in*: W.P. Clary, E.D. McArthur, D. Bedunah and C.L. Wambolt (eds.). Proceedings of the Symposium on Ecology and Management of Riparian Shrub Communities, May 29-31, 1991, Sun Valley, Idaho. U.S. Forest Service, Intermountain Forest and Research Station, Ogden, Utah.

Adams, P.C., and L.A. Viereck. 1997. Soil Temperature and Seasonal Thaw: Controls and Interactions in Flood Plain Stands Along the Tanana River, Interior Alaska. Pages 105-111 *in*: I.K. Iskandar, E.A. Wright, J.K. Radke, B.S. Sharratt, P.H. Groenevelt and L.D. Hinzman (eds.). International Symposium on Physics, Chemistry, and Ecology of Seasonally Frozen Soils, June 10-12, 1997, University of Alaska, Fairbanks. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

ADCED. 1978. The Alaska Economic Information and Reporting System, Quarterly Report. January. Alaska Department of Community and Economic Development.

ADCED. 1998. Alaska Community Database. From web site: http://www.dced.state.ak.us/mra/CF_COMDB.htm. Alaska Department of Community and Economic Development.

ADCED. 1999. Alaska Community Database. From web site: http://www.dced.state.ak.us/mra/CF_COMDB.htm. Alaska Department of Community and Economic Development.

ADCED. 2000. Alaska Community Database. From web site: http://www.dced.state.ak.us/mra/CF_COMDB.htm. Alaska Department of Community and Economic Development.

ADCED. Annual. Alaska Taxable. Alaska Department of Community and Economic Development.

ADCRA. 1976. Report on FY 75 Trans-Alaska Pipeline Impact Expenditures by State and Local Governments. Alaska Department of Community and Regional Affairs.

ADEC. 1999. Alaska Department of Environmental Conservation, Division of Spill Prevention and Response, Prevention and Emergency Response Program. http://www.state.ak.us/local/akpages/ENV.CONSERV/dspar/perp/home.htm

ADF&G. 1976. Bison in Interior Alaska – Delta Bison Management Plan. Pages 90-93 *in:* Alaska Wildlife Management Plans: A Public Proposal for the Management of Alaska's Wildlife. Interior Alaska. Alaska Department of Fish and Game, Subsistence Division, Juneau, Alaska.

ADF&G. 1986a. Distribution, Abundance, and Human Use of Fish and Wildlife - Alaska Habitat Management Guide, Arctic Region, Volume II. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

ADF&G. 1986b. Distribution, Abundance, and Human Use of Fish and Wildlife - Alaska Habitat Management Guide, Western and Interior Region. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

ADF&G. 1986c. Distribution, Abundance, and Human Use of Fish and Wildlife - Alaska Habitat Management Guide, Southcentral Region, Volume II. Alaska Department of Fish and Game, Habitat Division. Juneau, Alaska.

ADF&G. 1993. List of Species of Special Concern. Alaska Department of Fish and Game, Juneau, Alaska.

ADF&G. 1994. Subsistence in Alaska: 1994 Update. Alaska Department of Fish and Game.

ADF&G. 1994a. Wildlife Notebook Series: Bowhead Whale. From web site: www.state.ak.us/local/akpages/FISH.GAME/notebook/marine/bowhead.htm.

ADF&G. 1996. List of Species of Special Concern. Alaska Department of Fish and Game, Juneau, Alaska.

ADF&G. 1997. Catch and Production in Alaska's Commercial Fisheries, 1995 ed. Alaska Department of Fish and Game.

ADF&G. 1998. List of Species of Special Concern. Alaska Department of Fish and Game, Juneau, Alaska.

ADF&G. 1999. Nelchina Caribou Update, July 30, 1999. From web site: www.state.ak.us/local/akpages/fish.game/wildlife/geninfo/news/nelchina.htm.

ADF&G. 1999a. Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes - Arctic Region Resource Management, Region V. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

ADF&G. 1999b. Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes - Interior Region Resource Management, Region VI. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

ADF&G. 1999c. Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes - Southcentral Region Resource Management, Region II. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

ADF&G. 1999d. Ex Vessel Value of Alaska Commercial Salmon Harvest. From web site: www.cf.adfg.state.ak.us/geninfo/finfish/salmon/catchval/bluesheet/.

ADF&G. 1999e. Commercial Fisheries Entry Commission. Commercial Fishing Statistics. Permit Holders and Crew by Census Area. From web site: www.cfec.state.ak.us/cencp/13ancho.htm.

ADF&G 1999f. Community Profile Database, Volume 5: Arctic Region. Alaska Department of Fish and Game, Juneau, Alaska.

ADF&G. 1999g. Alaska Hunting Regulations. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

ADF&G. Undated. Prudhoe Bay Closed Area Game Management Unit 26B, Map Information Series 26–01. Alaska Department of Fish and Game, Fairbanks, Alaska.

ADNR. 1986. Copper River Basin Area Plan. Alaska Department of Natural Resources, Anchorage, Alaska.

ADNR. 1997. Oil and Gas Lease Sale 86, Central Beaufort Sea: Final Finding of the Director, Alaska Department of Natural Resources, Division of Oil and Gas. Alaska Department of Natural Resources, Anchorage, Alaska.

ADNR. 1998. Oil and Gas Lease Sale 87, North Slope Areawide: Final Finding of the Director, Alaska Department of Natural Resources, Division of Oil and Gas. Alaska Department of Natural Resources, Anchorage, Alaska.

ADNR. 1999. Beaufort Sea Areawide 1999 Oil and Gas Lease Sale: Final Finding of the Director, Alaska Department of Natural Resources, Division of Oil and Gas. Alaska Department of Natural Resources, Anchorage, Alaska.

ADNR. 1999a. Alaska's Mineral Industry 1998: A Summary. Alaska Department of Natural Resources.

ADNR. 1999b. Interagency Fire Management Plans in Alaska: Role of Fire in the Alaskan Environment, and Fire Management Options in Alaska. Alaska Department of Natural Resources, Forestry Division, Anchorage, Alaska. From web site: www.dnr.state.ak.us/forestry/firemgmt.htm.

ADNR. 1999c. Historical and Projected Oil and Gas Consumption. Alaska Department of Natural Resources.

ADOL. 1976. Pipeline Completion. *Alaska Economic Trends*. Alaska Department of Labor. November.

ADOL. 1977. Alaska's Labor Market in September. *Alaska Economic Trends*. Alaska Department of Labor. November.

ADOL. 1978. An Oil Pipeline Employment Multiplier and Post Construction Residual in Employment. Alaska Department of Labor.

ADOL. 1981. Alaska Labor Force in September. *Alaska Economic Trends*. Alaska Department of Labor. November.

ADOL. 1982a. Valdez: The Least Seasonal Gulf Coast Community. *Alaska Economic Trends*. Alaska Department of Labor. November.

ADOL. 1982b. Alaska's Oil Industry. *Alaska Economic Trends*. Alaska Department of Labor. March.

ADOL. 1983a. Special Census Results for Oil Related Worksites in the North Slope Borough. *Alaska Economic Trends*. Alaska Department of Labor. March.

ADOL. 1983b. The Petroleum Industry: Alaska Compared to Other States. *Alaska Economic Trends*. Alaska Department of Labor. January.

ADOL. 1985. Rural Versus Urban Employment Growth 1980-1984. *Alaska Economic Trends*. Alaska Department of Labor. September.

ADOL. 1986. U.S. Employment Growth Rates: Alaska's Rate is Number One. *Alaska Economic Trends*. Alaska Department of Labor. June, 1986.

ADOL. 1988a. Turbulent Times in Alaska's Financial Industry. *Alaska Economic Trends*. Alaska Department of Labor. November, 1988.

ADOL. 1988b. Alaska's Northern Region. *Alaska Economic Trends*. Alaska Department of Labor. August, 1988.

ADOL. 1989a. Oil Spill Causes an Upward Revision in Employment Forecast. *Alaska Economic Trends*. Alaska Department of Labor. August.

ADOL. 1989b. An Overview of Alaska's Oil Industry. *Alaska Economic Trends*. Alaska Department of Labor. November.

ADOL. 1989c. Prince William Sound: Five Economies in Turmoil. *Alaska Economic Trends*. Alaska Department of Labor. July.

ADOL. 1989d. Spill Work Force Begins to Demobilize—Employment Picture Still Good. *Alaska Economic Trends*. Alaska Department of Labor. December.

ADOL. 1990. 1989: Economic Revival Plus an Oil Spill Boom. *Alaska Economic Trends*. Alaska Department of Labor. April.

ADOL. 1991. Accident Rate for Oil Spill Cleanup Not Unusual. *Alaska Economic Trends*. Alaska Department of Labor. September.

ADOL. 1992. A Look at Today's Economies in Prince William Sound. *Alaska Economic Trends*. Alaska Department of Labor. September.

ADOL. 1996. Federal Agencies Dominate Despite Downsizing. *Alaska Economic Trends*. Alaska Department of Labor. September.

ADOL. 1998a. Population Overview: 1997 Estimates. Alaska Department of Labor.

ADOL. 1998b. Employment and Earnings Summary Report for 1997. Alaska Department of Labor.

ADOL. 1999a. The High Cost of Living. *Alaska Economic Trends*. Alaska Department of Labor. June.

ADOL. 1999b. Research and Analysis Homepage. From web site: www.labor.state.ak.us/research. Alaska Department of Labor.

ADOL. 1999c. An Economic Profile: The Kenai Peninsula. *Alaska Economic Trends*. Alaska Department of Labor. October.

ADOL. 1999d. Alaska Population Estimates. From web site: www.labor.state.ak.us/research/pop/popest.htm. Alaska Department of Labor.

ADOL. 1999e. Per Capita Income. *Alaska Economic Trends*. Alaska Department of Labor. June.

ADOL. 1999f. Alaska Labor Force and Unemployment Alaska Department of Labor. From web site: www.labor.state.ak.us/research/emp.htm.

ADOL. 1999g. Prince William Sound, 10 Years After the Oil Spill — An Economic Profile. *Alaska Economic Trends*. Alaska Department of Labor. March.

ADOL. 1999h. The Trends 100. *Alaska Economic Trends*. Alaska Department of Labor. August.

ADOL. 2000. Nonresidents Working in Alaska in 1998. Alaska Department of Labor.

ADOL. Annual. Employment and Earnings. Alaska Department of Labor.

ADOR. 1998. Revenue Sources, Fall, 1998. Alaska Department of Revenue.

ADOR. 1999a. ANS Production. Washington D.C. From web site: www.revenue.state.ak.us/oga/production/prodCYFY.htm. Alaska Department of Revenue, Oil and Gas Audit Division.

ADOR. 1999b. Cook Inlet Production. Washington D.C. From web site: www.revenue.state.ak.us/oga/production/cookinlet.htm. Alaska Department of Revenue, Oil and Gas Audit Division.

ADOR. 1999c. Revenues Sources, Fall, 1999. Alaska Department of Revenue.

ADOR. 2000. Spring 2000 Revenue Sources Book. Alaska Department of Revenue.

ADOT. 1996. Moose/Vehicle Collision Mitigation Measures. Alaska Department of Transportation. From web site: www.dot.state.ak.us//external/hq/mat/projects/moose/htm.

ADOT. 1997. Alaska Traffic Accidents – 1997. Alaska Department of Transportation. From web site: www.dot.state.ak.us/external/state_wide/planning/97abstract.html.

ADOT. 1999. Average Annual Daily Traffic Counts 1977–1998. Alaska Department of Transportation.

AFN. 1989. The AFN Report on the Status of Alaska Natives: A Call for Action. Alaska Federation of Natives.

Agler, B.A., and S.J. Kendall. 1997. Marine Bird and Sea Otter Abundance of Prince William Sound, Alaska: Trends Following the T/V *Exxon Valdez* Oil Spill, 1989–96. *Exxon Valdez* Oil Spill Restoration Final Reports, Restoration Project 96159. Prepared for *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Agler, B.A., S.J. Kendall, D.B. Irons, and S.P. Klosiewski. 1999. Declines in Marine Bird Populations in Prince William Sound, Alaska, Coincident with a Climatic Regime Shift. *Waterbirds*, 22:98-103.

Agler, B.A., S.J. Kendall, and D.B. Irons. 1998. Abundance and Distribution of Marbled and Kittlitz's Murrelets in Southcentral and Southeast Alaska. *Condor* 100:254-265.

Ahtna, Inc. 1973. The Ahtna Region: Background for Regional and Community Planning. Ahtna, Inc. with assistance from the Arctic Environmental Information and Data Center, Copper Center, Alaska.

AKNHP. 2000. Alaska Zoological Biodiversity – U.S. Forest Service (Region 10) Sensitive Species List, Alaska Region, January 1974. Found at web site: http://www.uaa.alaska.edu/enri/aknhp_web/biodiversity/zoological/spp_of_concern/species_list/fssen.html. Alaska Natural Heritage Program.

Alaska Coastal Management Program. 1986. Cordova Coastal Management Program.

Alaska Consultants, Inc. 1979. Northern and Western Gulf of Alaska Local Socioeconomic Baseline. Prepared for Bureau of Land Management, Alaska Outer Continental Shelf Office: 539, Anchorage, Alaska.

Alaska Earthquake Information Center. 2000. Query of Earthquake Database.

Alaska Historical Society. 1999. Welcome to Rika's Roadhouse. Alaska Historical Society web page.

Alaska Natives Commission. 1994. Alaska Natives Commission Report.

Alaska Natural Heritage Program. 2000. Vascular Plant Tracking List. From web site: http://www.uaa.alaska.edu/enri/aknhp_web/index.html

Alaska Permanent Fund Corporation. 2000. Permanent Fund Division History. From web site: www.revenue.state.ak.us/pfd/BASHIS.htm.

Alaska Permanent Fund Corporation. Annual. Annual Report.

Alaska Pipeline Office. 1978. Criteria for Determining Success of Restoration of Disturbed Sites on the Trans-Alaska Pipeline System. U.S. Department of the Interior.

Albers, P.H. 1980. Transfer of Crude Oil from Contaminated Water to Bird Eggs. *Environmental Research* 22 :307-314.

ALC. 1962. Revenue and Taxation in Alaska. Alaska Legislative Council Prepared for the Alaska State Legislature.

Alexander, H.L. 1974. The Association of Aurignacoid Elements with Fluted Point Complexes in North America. Pages 21-31 *In:* S. Raymond and P. Schledermann (eds.). International Conference on the Prehistory and Palaeoecology of Western North American Arctic and Subarctic. University of Calgary Archaeological Association, Calgary, Alberta, Canada.

Alexander, H.L. 1987. Putu: A Fluted Point Site in Alaska. Publication No. 17. Department of Archaeology, Simon Frazer University, Burnaby, British Columbia, Canada.

Allaye-Chan, A.C. 1991. Physiological and Ecological Determinants of Nutrient Partitioning in Caribou and Reindeer. A thesis for Ph.D. presented to the faculty of the University of Alaska, Fairbanks. 135 pp.

Allen, H.T. 1900. Military Reconnaissance in Alaska. *in*: Compilation of Narratives of Explorations in Alaska. Government Printing Office, Washington, D.C.

Alt, G.L. 1984. Black Bear Cub Mortality Due to Flooding of Natal Dens. *Journal of Wildlife Management,* 48:1432-1434.

Ambrose, R. 1999. Endangered Species Biologist, U.S. Fish and Wildlife Service, Fairbanks, Alaska, personal communication, September 19,1999.

Ambrose, R.E., R.J. Ritchie, C.M. White, P. Schempf, T. Swem, and R. Dittrick. 1988. Changes in the Status of Peregrine Falcons in Alaska. Pages 73–82 *in:* T.J. Cade et al., (eds.). *Peregrine Falcon Populations.* The Peregrine Fund, Boise, Idaho.

American Ornithologists' Union. 1998. Check-list of North American Birds. Seventh ed. Allen Press, Lawrence, Kansas.

American Ornithologists' Union. 2000. Forty-second Supplement to the American Ornithologists' Union Check-list of North American Birds. *Auk* 117:847-858.

Amstrup, S.C., I. Stirling, and J.W. Lentfer. 1986. Past and Present Status of Polar Bears in Alaska. *Wildlife Society Bulletin* 143:241-254.

Amstrup, S.C. 1995. Movements, Distribution, and Population Dynamics of Polar Bears in the Beaufort Sea. Ph.D. thesis, University of Alaska, Fairbanks.

Amstrup, S.C., C. Gardner, K.C. Myers, and F.W. Oehme. 1989. Ethylene Glycol (antifreeze) Poisoning in a Free-ranging Polar Bear. *Veterinary and Human Toxicology,* 31:317–319.

Amstutz, D.E., and W.B Samuels. 1984. Offshore Oil Spills: Analysis of Risks. *Marine Environmental Research,* 13:303–319.

Amuzegar, J. 1999. Managing the Oil Wealth. I.B. Tauris & Co., Ltd., London, UK.

Anderson, B.A., S.M. Murphy, M.T. Jorgenson, D.S. Barber, and B.A. Kugler. 1992. GHX-1 Waterbird and Noise Monitoring Program. Unpublished report prepared by Alaska Biological Research, Inc. and BBN Systems and Technologies. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Anderson, B.A., R.J. Ritchie, B.E. Lawhead, J.R. Rose, A.M. Wildman, and S.F. Schlentner. 2000. Wildlife Studies at Fort Wainwright and Fort Greely, Central Alaska, 1998. Final report prepared by Alaska Biological Research, Inc. Prepared for U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, and U.S. Army, Anchorage, Alaska.

Anderson, B.A., R.J. Ritchie, and A.A. Stickney. 1996. Avian Studies in the Kuparuk Oilfield, Alaska, 1995. Final report prepared by Alaska Biological Research, Inc. Prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, Alaska.

Anderson, B.A., R.J. Ritchie, A.A. Stickney, and A.M. Wildman. 1999. Avian Studies in the Kuparuk Oilfield, Alaska, 1998. Draft report prepared by Alaska Biological Research, Inc. Prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, Alaska.

Anderson, B.A., A.A. Stickney, R.J. Ritchie, and B.A. Cooper. 1995. Avian Studies in the Kuparuk Oilfield, Alaska, 1994. Final report prepared by Alaska Biological Research, Inc. Prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, Alaska.

Anderson, C.M., and R.P. LaBelle. 1990. Update of Occurrence Rates for Accidental Oil Spills on the U.S. Outer Continental Shelf. *Oil and Chemical Pollution,* 6(21):21–35.

Anderson, C.M., and R.P. LaBelle. 1994. Comparative Oc-

currence Rates for Offshore Oil Spills. *Spill Science and Technology Bulletin,* 1(2):131-141.

Anderson, D.B., and C.L. Alexander. 1992. Subsistence hunting patterns and compliance with moose harvest reporting requirements in rural interior Alaska. ADF&G Division of Subsistence. Technical paper no. 215. Juneau, Alaska. 24 pp.

Anderson, D.D. 1968. A Stone Age Campsite at the Gateway to America. *Scientific American*, 218(6).

Anderson, D.D. 1970. Microblade Traditions in Northwestern Alaska. *Arctic Anthropology*, 7(2).

Anderson, D.D. 1984. Prehistory of North Alaska. *in:* D. Damas (ed.). Handbook of North American Indians, Arctic (V). Smithsonian Institution, Washington, D.C.

Anderson, C.M., D.G. Roseneau, B.J. Walton, and P.J. Bente. 1988. New Evidence of a Peregrine Migration on the West Coast of North America. Pages 507-516 *in:* T.J. Cade, J.H. Enderson, C.G. Thelander, and C.M. White (eds.). Peregrine Falcon Populations: Their Management and Recovery. Braun-Brumfield, San Francisco, California.

Andrews, E.F. 1975. Salcha: An Athabaskan Band of the Tanana Rivers and its Culture. M.A thesis, University of Alaska.

Andrews, E.F. 1977. Report on the Cultural Resources of the Doyon Region, Central Alaska. Occasional Paper No. 5, Volume 2. Anthropology and Historic Preservation Cooperative Studies Unit, University of Alaska, Fairbanks.

Anonymous. 1970. Dr. William Mitchell: Conservation is His Business. *Agroborealis,* 2(2):34

Anthony, J. 1995. Habitat Utilization by Sea Otters (*Enhydra lutris*) in Port Valdez, Prince William Sound, Alaska. M.S. thesis, University of Alaska, Fairbanks.

AOGA. 1984. A Survey of the Socioeconomic Impact of Alaska's Petroleum Industry on Private and Public Sectors of the State of Alaska and its Political Subdivisions. Prepared by M.I.A., Inc. and Hellenthal and Associates. Prepared for the Alaska Oil and Gas Association, Anchorage, Alaska.

API. 1991. Basic Petroleum Data Book Vol XI, No. 3. American Petroleum Institute, Washington, D.C.

APSC. 1973. Criteria and Design Basis for the Trans-Alaska Pipeline. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1973b. Summary Report: Basis for Earthquake Design for the Trans-Alaska Pipeline System, Appendix A-3.1051A.. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1974a. Terrain Unit Maps. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1974b. Summary Report, River and Floodplain Design Criteria for the Trans-Alaska Pipeline System. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1975. Pipeline Yearly Report, 1975. Unpublished. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1977-present. Discharge Monitoring Reports to U.S. EPA for NPDES Permits. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1990. Applications for Prevention of Significant Deterioration Approval and Air Quality Control Permit to Operate, Pump Stations 2 and 7, Rim Cooling Projects. Submitted to Alaska Department of Environmental Conservation October 25, 1990.

APSC. 1993. Environmental Atlas of the Trans-Alaska Pipeline System. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1995a. Coastal Resources and Areas of Public Concern for Prince William Sound and Portions of the Southcentral Coast of Alaska. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1995c. Letter No. 95-3091-G to Michael A. Conway, ADEC, from R.A. Abel, RE: Alyeska Pipeline Service Company (Alyeska) Mixing Zone Application, Section 401 Certification, Valdez Marine Terminal, NPDES Permit Renewal, Alaska-002324-8, July, 26, 1995. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1995d. Letter No. 95-7099 to Jerry Brossia and John Santora, Joint Pipeline Office. July 11, 1995. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1997a. Tractor Tug Selection Completed. Press release. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1997b. Trans-Alaska Pipeline System. Briefing document prepared by Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1997c. Final Report for Dispersion Modeling of a Generic Pump Station Along the Trans-Alaska Pipeline. Submitted to Alaska Department of Environmental Conservation, June, 1997. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC, 1997d. TAPS Operating Permit Application, Valdez Marine Terminal. Submitted to Alaska Department of Environmental Conservation. Prepared by SECOR International Inc. for Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1998a. Letter No 98-12682, NPDES Permit AK005056-3 Permit Renewal, by L.C. Jones, dated January 29, 1998. Alyeska Pipeline Service Company.

APSC. 1998c. Best Management Practices Plan, Ballast Water Treatment Facility, Alyeska Marine Terminal (MP-69-1), Second edition. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1998d. Alaska Native Utilization Agreement. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1998e. Environmental Protection Manual, Vol. 1, Section 5: Fish, Wildlife, and Archaeological Resources. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999a. Enhanced Tractor Tugs. Press release, January.

Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999b. Quick Reference Guide SERVS Equipment. Press release. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999c. Trans Alaska Pipeline System Facts. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999d. Spill Prevention and Response in Alaska's Prince William Sound. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999e. Air Quality Permit Files, Air Quality Control Permits to Operate, Pump Stations 1 - 12, March 4, 1996. VMT, June 7, 1996. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999f. Prince William Sound Tanker Spill Prevention and Response Plan. Parts 1–3. Alyeska Document Nos. PWS–201, 202, 203. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 1999g. Glacier Surge Monitoring Report. File Number 17.1 Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 2000. TransAlaska Pipeline System FACTS. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 2000b. Environmental Protection Manual, EN-43-1, Section 8. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. 2000c. 1999 Summary Reports: MP 166 M&R System Integrity Monitoring Program Procedures. Letter to the Joint Pipeline Office. Letter No. JPO #00-15602, March 31, 2000. Alyeska Pipeline Service Company, Anchorage, Alaska.

APSC. Annual. Earnings and Employment. Alyeska Pipeline Service Company.

APSC. nd. Fish Stream Database. Alyeska Pipeline Service Company.

Archibald, W.R., R. Ellis, and A.N. Hamilton. 1987. Responses of Grizzly Bears to Logging Truck Traffic in the Kimsquit River Valley, British Columbia. *International Conference on Bear Research and Management*, 7:251-257.

ARCO Alaska Inc., Anadarko Petroleum Corp., and Union Texas Petroleum Alaska Corp. 1996. Alpine Development Project Environmental Evaluation Document, October 1996. Prepared by Parametrix, Inc., Kirkland, Washington in association with ABR Inc., Michael Barker Jr., Inc., Robert Griffeth, MJM Research, John Lobdell, Shannon and Wilson, and OCC. Prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Armentrout, D.J., and R.J. Boyd. 1994. Consequences of habitat fragmentation on wild sheep metapopulation management within USA. Biennial Symposium of the Northern Wild Sheep and Goat Council 9:149-158.

Armstrong, R. 1970. Age, food, and migration of Dolly Varden smolts in Southeastern Alaska. *Journal of the Fisheries Research Board of Canada*, 27:991-1004.

Armstrong, R. 1984. Migration of Anadromous Dolly Varden Char in Southeastern Alaska - A Managers Nightmare. Pages 559-570 *in:* L. Johnson and B.L. Burns, (eds.). Biology of the Arctic Charr. Proceedings of the International Symposium on Arctic charr, Winnipeg, Manitoba, Canada. May 1981. University of Manitoba Press.

Armstrong, R.H., and J.E. Morrow. 1980. The Dolly Varden Charr, *Salvelinus malma*. Pages 99-140 *in:* E.K. Balon (ed). Charrs: Salmonid Fishes of the Genus *Salvelinus*. Dr. W. Junk Publishers, The Hague, Netherlands.

Arndt, K. 1977. The Structure of Cache Pits at GUL–077, A Late Prehistoric Archaeological Site Near Gulkana, Alaska. M.A. thesis, University of Alaska, Fairbanks.

Arnold, R.D. 1978. Alaska Native Land Claims. The Alaska Native Foundation, Anchorage, Alaska.

ARRC. 1999. Alaska Railroad History. From web site: www.akrr.com/History/history/html. Alaska Railroad Corporation.

Arthur D. Little Company. 1998. Gas-to-Liquids Fuel Conversion: Ready for the 21st Century. White paper.

Artois, M., M. Aubert, J. Blancon, M.L. Poulle, and P. Stahl. 1991. Behavioral Ecology of Rabies Transmission. *Ann. Rech. Vet.* 22:163-172.

ASHA. 1971. Community Impact of the Trans-Alaska Pipeline. Alaska State Housing Authority and Office of the Governor.

Associated Press. 1998a. Aging Oil Infrastructure Cuts into North Slope Borough Budget. *Anchorage Daily News*. Final Edition, Metro Section, p. B4. January 25, 1998.

Associated Press. 1998b. Owners Reject Plan to Freeze Pipeline Worth for 5 Years. *Anchorage Daily News*. Final Edition, Metro Section, p. C1. December 22, 1998.

Association of Oil Pipelines. 1999. Annual Report, Shifts in Pipeline Transportation. Washington, D.C.

Auerbach, N.A., M.D. Walker, and D.A. Walker. 1997. Effects of Roadside Disturbance on Substrate and Vegetation Properties in Arctic Tundra. *Ecological Applications*, 7:218-235.

Aus, W. 2000. Alyeska Pipeline Service Company, personal communication, November 13, 2000.

Aus, W.T., G.W. Pomeroy , and J.D. Norton. 2000. Mainline Valve Operations and Maintenance program on the Trans-Alaska Pipeline. ETCE/OMAE conference proceedings. New Orleans, Louisiana.

Bailey, E.P. 1993. Introduction of Foxes to Alaskan Islands - History, Effects on Avifauna, and Eradication. U.S. Fish and Wildlife Service, Homer, Alaska. 54 pp.

Bailey, E. and D. McCargo. 1984. Eradication of Fox on Bird Island and Incidental Surveys of Seabirds in the Shumagin Islands, Alaska. May-June 1984. U.S. Fish and Wildlife Service. Homer, Alaska. 16 pp.

Bailey, T.N., E.E. Bangs, M.F. Portner, J.C. Malloy, and R.J. McAvinchey. 1986. An Apparent Overexploited Lynx Population on the Kenai Peninsula, Alaska. *Journal Wildlife Management*, 50:279-290.

Ballard, W. 1999. Texas Tech University, personal communication, November 10, 1999.

Ballard, W.B., and P.S. Gipson. 2000. Wolf. Pages 321-346 *in:* S. Demaris and P. R. Krausman, (eds.). Ecology and Management of Large Mammals in North America. Prentice-Hall, Inc., New Jersey.

Ballard, W.B., and P.R. Krausman. 1997. Occurrence of Rabies in Wolves of Alaska. *Journal of Wildlife Diseases*, 33:242-245.

Ballard, W.B., and D.G. Larsen. 1987. Implications of Predator-prey Relationships to Moose Management. Pages 581-602 *in:* G. Goransson and S. Lavsund, (eds.). Proceedings of the Second International Moose Symposium, Uppsala, Sweden.

Ballard, W.B., and S.D. Miller. 1990. Effects of Reducing Brown Bear Density on Moose Calf Survival in South-central Alaska. *Alces*, 26:9-13.

Ballard, W.B., L.A. Ayres, P.R. Krausman, D.J. Reed, and S.G. Fancy. 1997. Ecology of Wolves in Relation to a Migratory Caribou Herd in Northwest Alaska. *Wildlife Monograph*, No.135.

Ballard, W.B., M.A. Cronin, M.D. Robards, and E.H. Follmann. 2000a. Body Sizes, Ages, Reproductive Status, and Sex Ratios of Arctic Foxes in the Prudhoe Bay Oil Field, Alaska. *Canadian Field-Naturalist*, 114: in press.

Ballard, W.B., M.A. Cronin, and H.A. Whitlaw. 2000. Interactions Between Caribou and Oil Fields: The Central Arctic Caribou Herd Case History. Pages 85-104 *in:* J.C. Truett and S.R. Johnson (eds.). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Ballard, W.B., S. Miller, and T.H. Spraker. 1980. Moose Calf Mortality Study. Federal Aid in Wildlife Restoration Final Report, Projects W-17-9, W-17-10, W-17-11, and W-21-1, Job 1.23R. Alaska Department of Fish and Game, Juneau, Alaska.

Ballard, W.B., S.D. Miller, and T.H. Spraker. 1982. Home Range, Daily Movements, and Reproductive Biology of Brown Bear in Southcentral Alaska. *Canadian Field-Naturalist*, 96:1-5.

Ballard, W.B., S.D. Miller, and J.S. Whitman. 1990. Brown and Black Bear Predation on Moose in South-central Alaska. *Alces*, 26:1-8.

Ballard, W.B., T.H. Spraker, and K.P. Taylor. 1981. Causes of neonatal moose calf mortality in south-central Alaska. *Journal of Wildlife Management*, 45:335-342.

Ballard, W.B., J.S. Whitman, and C.L. Gardner. 1985. Susitna Hydroelectric Project 1984 Annual Report. Big Game Studies. Vol II – Moose Upstream. Alaska Department of Fish and Game, Anchorage, Alaska.

Ballard, W.B., J.S. Whitman, and C.L. Gardner. 1987. Ecology of an Exploited Wolf Population in South-central Alaska. *Wildlife Monograph*, No. 98.

Ballard, W.B., J.S. Whitman, and D.J. Reed. 1991. Population Dynamics of Moose in South-central Alaska. *Wildlife Monograph*, No. 114.

Banfield, A.W., R.D. Jakimchuk, and R.D. Cameron. 1981. An Assessment of Issues Concerning Caribou and North Slope Petroleum Development. Caribou Advisory Panel Final Report. Prepared for ARCO Alaska, Inc., Chevron USA, Inc., Conoco, Inc., EXXON Company, USA, Shell Oil Company, and SOHIO Alaska Petroleum Company, Anchorage, Alaska.

Barnes, F.F. 1967. Coal Resources of Alaska. Page B22 *in:* U.S. Geological Survey Bulletin 1242-B.

Barnett, J.A. (ed.). 1983. Caribou. Annual Report of Survey-inventory Activities. Federal Aid in Wildlife Restoration Project W-22-1. Job 3.0.

Barnett, J.A. (ed.). 1984. Caribou. Annual Report of Survey-inventory Activities. Federal Aid in Wildlife Restoration Project W-22-2. Job 3.0.

Barry, T.W., and R. Spencer. 1976. Wildlife Response to Oil Well Drilling. Canadian Wildlife Service Progress Notes No. 67.

Barsdate, R.J., M.C. Miller, V. Alexander, J.R. Vestal, and J.E. Hobbie. 1980. Oil Spill Effects. Pages 388-407 *in*: J. E. Hobbie (ed), Limnology of Tundra Ponds. Dowden, Hutchinson and Ross, Inc., Stroudsberg, PA.

Baskurt, U.J., P. Bradshaw, and J. Hart. 1998. Slackline Testing of the Trans-Alaska Pipeline System at Thompson Pass, International Pipeline Conference, Calgary, Alberta, Canada.

Beasley, R.M., and M.E. McNay. 1989. Game Management Units 20A, 20B, 20C and 20F, Central-Lower Tanana River Drainage. Pages 85-96 *in:* S. O. Morgan, (ed.). Annual Report of Survey-Inventory Activities. Part IV. Black Bear. Federal Aid in Wildlife Restoration Progress Report, Vol. XIX. Project W-23-1, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

Bechtol, W.R. 1995. Commercial Groundfish Fisheries in the Central Region, 1994. Regional Information Report 2A95-32. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Anchorage, Alaska.

Bee, J.W., and E.R. Hall. 1956. Mammals of Northern Alaska on the Arctic Slope. Miscellaneous Publication No. 8. University of Kansas Museum of Natural History, Lawrence, Kansas.

Behnke, R.J. 1980. A Systematic Review of the Genus *Salvelinus.* Pages 441-480 *in* E.K. Balon, and De. W. Junk (eds.). 1980. Charrs: Salomonid Fishes of the Genus *Salvelinus*. The Hague, Netherlands.

Behnke. 1984. Organizing the Diversity of the Arctic Charr Complex. Pages 3-21 *in* L. Johnson and B.L. Burns (eds.). 1984. Biology of the Arctic Charr. Proceedings of the International Symposium on Arctic Charr. University of Manitoba Press. Winnipeg, Manitoba, Canada.

Bekoff, M. 1977. *Canis latrans*. Mammalian Species No. 79. American Society of Mammalogists.

Bekoff, M. 1982. Coyote. Chapter 20 *in:* J. A. Chapman and G. A. Feldhamer, (eds.). Wild Mammals of North America. John Hopkins University Press, Baltimore, Maryland.

Ben-David, M., R.W. Flynn, and D.M. Schell. 1997. Annual and Seasonal Changes in Diets of Martens: Evidence from Stable Isotope Analysis. *Oecologia*, 111:280-291.

Bendock, T.N. 1979a. Beaufort Sea Estuarine Fishery Study. *in:* Environmental Assessment of the Alaskan Continental Shelf, Final Reports of the Principal Investigators, Volume 4:670-729. Bureau of Land Management/National Ocean and Atmospheric Administration, OCSEAP, Boulder, Colorado.

Bendock, T.N. 1985. Alaska Department of Fish and Game (retired), arctic area fisheries biologist, personal communication.

Bendock, T.N., and J. Burr. 1984. Freshwater Fish Distributions in the Central Arctic Coastal Plain (Ikpikpuk River to Colville River). Alaska Department of Fish and Game, Sport Fish Division, Fairbanks, Alaska.

Bendock, T.N., and J.M. Burr. 1986. Arctic Area Trout Studies. Federal Aid in Fish Restoration and Anadromous Fish Studies, 1985-1986, Volume 27, Study T-7-1. Alaska Department of Fish and Game, Sport Fish Division, Juneau, Alaska.

Benson, A.M. 1999. Distribution of Landbirds Among Habitats on the Tanana Flats and Yukon Maneuver Area, Fort Wainwright, Alaska 1998. Final report prepared by Alaska Bird Observatory, Fairbanks, Alaska. Prepared for U.S. Fish and Wildlife Service, Anchorage, Alaska.

Bente, P. 1997. Western Arctic Herd. Pages 24-26 *in:* M. V. Hicks, (ed.). 1997. Caribou. Annual Performance Report of Survey-inventory Activities, 1 July 1996-30 June 1997. Federal Aid in Wildlife Restoration, Grant W-24-5, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Berg, R.L. 1980. Road Performance and Associated Investigations. Pages 53-100 *in:* J. Brown, and R. L. Berg, (eds.). Environmental Engineering and Ecological Baseline Investigations Along the Yukon River-Prudhoe Bay Haul Road. CRREL Report 80-19. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Berger, M. 1996. Summer Habitat Relationships and Foraging Ecology of the Delta Bison Herd. M.S. thesis, University of Alaska, Fairbanks.

Berger, T.R. 1985. Village Journey: The Report of the Alaska Native Review Commission. Hill and Wang, New York.

Bergerud, A.T., and R.E. Page. 1987. Displacement and Dispersion of Parturient Caribou at Calving as Antipredator Tactics. *Canadian Journal of Zoology*, 65:1597-1606.

Bergerud, A.T., and W.B. Ballard. 1988. Wolf Predation on Caribou: The Nelchina Herd Case History, a Different Interpretation. *Journal of Wildlife Management*, 52:344-357.

Bergerud, A.T., and W.B. Ballard. 1989. Wolf Predation on the Nelchina Caribou Herd: A Reply. *Journal of Wildlife Management*, 53:251-259.

Bergerud, A.T., R.D. Jakimchuk, and D.R. Carruthers. 1984. The Buffalo of the North: Caribou (*Rangifer tarandus*) and Human Developments. *Arctic*, 37:7-22.

Bergman, R.D., and D.V. Derksen. 1977. Observations on Arctic and Red-throated Loons at Storkersen Point, Alaska. *Arctic*, 30:41–51.

Bergman, R.D., R.L. Howard, K.F. Abraham, and M.W. Weller. 1977. Water Birds and Their Wetland Resources in Relation to Oil Development at Storkersen Point, Alaska. Resource Publication 129. U.S. Fish and Wildlife Service, Washington, D.C.

Berman, M., E. Larson, and B. Tuck. 1992. Natural Resource Depletion and Social Income Accounting: Sustainable Income in Petroleum Dependent Economies. *in:* OPEC Review, Winter 1992 (supplement).

Berman, M., E. Myers, W. Nebesky, K. White, and T. Hull. 1984. Alaska Petroleum Revenues: The Influence of Federal Policy. Institute of Social and Economic Research, University of Alaska, Anchorage.

Bernard, D.R., K.R. Hepler, J.D. Jones, M.E. Whalen, and D.N. McBride. 1995. Some Tests of the “Migration Hypothesis” for Anadromous Dolly Varden (Southern Form). *Transactions of the American Society*, 124:297-307.

Bernatowicz, J.A., P.F. Schempf, and T.D. Bowman. 1996. Bald Eagle Productivity in South-central Alaska in 1989 and 1990 After the *Exxon Valdez* Oil Spill. Pages 785–797 *in:* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (eds.). Proceedings of the *Exxon Valdez* Oil Spill Symposium. American Fisheries Society Symposium No. 18. American Fisheries Society, Bethesda, Maryland.

Bernton, H. 1987a. Coast Guard Tries to Determine Cause of Oil Spill. Page A1 *in: Anchorage Daily News.* July 25, 1987.

Bernton, H. 1987b. Tankers Kept Out of Ports, State Wants to See Spill Cleanup Plans. Page A1 *in: Anchorage Daily News.* July 24, 1987.

Berrie, P.M. 1973. Ecology and Status of Lynx in Interior Alaska. Pages 4-41 *in:* R. L Eaton, (ed.). The World’s Cats, Vol. 1, Ecology and Conservation. World Wildlife Safari, Winston, Oregon.

Betts, M. 1997. Subsistence Harvest and Use Patterns for Rampart, Tanana, Stevens Village, Manley Hot Springs–Eureka, and Minto, Alaska: Eureka-Rampart Road Study Environmental Assessment. Alaska Department of Transportation and Public Facilities, Fairbanks, Alaska.

Bilderback, D. 1956. Mailboat. Pages 31–32 *in: Alaska Sportsman*, November 12–15.

Billbe, M. 1999. Bureau of Land Management, personal com-

munication, November, 29, 1999.

Billings, W.D. 1987. Constraints to Plant Growth, Reproduction, and Establishment in Arctic Environments. *Arctic and Alpine Research*, 19:357-365.

Billings, W.D., and K.M. Peterson. 1980. Vegetational Change and Ice-wedge Polygons Through the Thaw-lake Cycle in Arctic Alaska. *Arctic and Alpine Research*, 12:413-432.

Billings, W.D., K.M. Peterson, J.O. Luken, and D.A. Mortensen. 1984. Interaction of Increasing Atmospheric Carbon Dioxide and Soil Nitrogen on the Carbon Balance of Tundra Microcosms. *Oecologia*, 65:26-29.

Binford, L.R. 1978. Nunamiut Ethnoarchaeology: A Case Study in Archaeological Formation Processes. Academic Press, New York.

Birket–Smith, K., and F. De Laguna . 1938. The Eyak Indians of the Copper River Delta, Alaska. Copenhagen, Levin, and Munksgaard.

Bishop, S.C., J.G. Kidd, T.C. Cater, L.J. Rossow, and M.T. Jorgenson. 1999. Land Rehabilitation Studies in the Kuparuk Oilfield, Alaska, 1998. Thirteenth Annual Report. Prepared by ABR, Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Bishop, R.H. 1967. Reproduction Age Determination and Behavior of the Harbor Seal, *Phoca Nitulina L.*, in the Gulf of Alaska. M.S. Thesis, University of Alaska, Fairbanks, Alaska. 121 pp.

Bleich, V.C., R.T. Bowyer, A.M. Paulie, M.C. Nicholson, and R.W. Anthes. 1994. Mountain Sheep *Ovis Canadensis* and Helicopter Surveys: Ramifications for the Conservation of Large Mammals. *Biological Conservation*, 70:1-7.

Bliss, L.C., and J.E. Cantlon. 1957. Succession on River Alluvium in Northern Alaska. *American Midland Naturalist*, 58:452-469.

Bliss, L.C., and K.M. Peterson. 1992. Plant Succession, Competition, and Physiological Constraints of Species in the Arctic. *in*: F.S. Chapin, III, R.L. Jefferies, J.F. Reynolds, G.R. Shaver, and J.Svoboda (eds.). Arctic Ecosystems in a Changing Climate: an Ecophysiological Perspective. Academic Press, San Diego, California.

BLM. 1956. The Alaska Railroad, History and Organization. Prepared by U.S. Department of Interior, Bureau of Land Management.

BLM. 1972. Final Environmental Impact Statement, Proposed Trans-Alaska Pipeline. Prepared for the Federal Task Force on Alaskan Oil Development by the U.S. Bureau of Land Management, Alaska Office, Anchorage, Alaska.

BLM. 1976. Alaska Natural Gas Transportation System Final Environmental Impact Statement. Prepared by U.S. Department of Interior, Bureau of Land Management, Washington, D.C.

BLM. 1978. National Petroleum Reserve in Alaska 105(C) Land Use Study, Socioeconomic Profile. National Petroleum Reserve in Alaska Task Force Study Report 3. Includes an oversize map and summary information sheet for each community and the region. Bureau of Land Management, NPR-A Task Force, Anchorage, Alaska.

BLM. 1979. National Petroleum Reserve in Alaska 105(C) Final Study, Volume 1: Summaries of Values and Resource Analysis and Land Use Options (Excluding Petroleum Values and Uses). Bureau of Land Management, NPR-A Task Force, Anchorage, Alaska.

BLM. 1981. Alaska Interagency Fire Management Plan: Tanana/Minchumina Planning Area and Environmental Analysis. Bureau of Land Management, Division of Forestry – Fire Management, Anchorage, Alaska.

BLM. 1983a. Oil and Gas Leasing in the National Petroleum Reserve in Alaska, Final EIS. Bureau of Land Management, Anchorage, Alaska.

BLM. 1983b. 810 Analysis. Bureau of Land Management, Anchorage, Alaska.

BLM. 1984. A Pictorial Report of Trans-Alaska Pipeline Oil Spills. Alaska State Office, Bureau of Land Management, Branch of Pipeline Monitoring, Anchorage, Alaska.

BLM. 1987a. Branch of Pipeline Monitoring Open File Report — TAPS Fish Streams. Bureau of Land Management, Alaska State Office, Division of Minerals Branch of Pipeline Monitoring, Anchorage, Alaska.

BLM. 1987b. Zones of Restricted Activity for Protection of Key Fish Areas Along TAPS on Federally Administered Lands. Bureau of Land Management, Alaska State Office, Division of Minerals Branch of Pipeline Monitoring, Anchorage, Alaska.

BLM. 1988. Muskox Reintroduction – Environmental Assessment. Bureau of Land Management, Arctic District Office, Fairbanks, Alaska.

BLM. 1989. Utility Corridor Proposed Resource Management Plan and Final Environmental Impact Statement. Bureau of Land Management, Arctic District Office, Fairbanks, Alaska.

BLM. 1991. Utility Corridor Resource Management Plan/Environmental Impact Statement – Record of Decision. Bureau of Land Management, Alaska State Office, Anchorage, Alaska.

BLM. 1998. Picture Tour of the Dalton Highway: Questions About Traveling the Dalton Highway. Bureau of Land Management, Dalton Management Unit. Web site: www.aurora.ak.blm.gov/dalton/tour/facts1.htm.

BLM and MMS. 1998. Northeast National Petroleum Reserve-Alaska, Final Integrated Activity Plan/Environmental Impact Statement. Volumes 1 and 2. Prepared by U.S. Department of Interior, Bureau of Land Management and Minerals Management Service, Anchorage, Alaska. Government Printing Office, Washington, D.C.

BLM and USACE. 1988. Trans-Alaska Gas System, Final Environmental Impact Statement. BLM-Alaska-PT-88-003-1792-910. Prepared by Bureau of Land Management and U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

BLM and USGS. 1992. Environmental Status of 28 Oil and Gas Exploration Areas of Operation in the National Petroleum Reserve, Alaska.

Bockstoce, J.R. 1986. Whales, Ice, and Men: The History of Whaling in the Western Arctic. University of Washington Press, Seattle, Washington.

Boertje, R.D., M.A. Keech, and B.W. Dale. 1999. Factors Limiting Moose at High Densities in Unit 20A. Federal Aid in Wildlife Restoration Research Progress Report Grant W-27-1, Study 1.51. Alaska Department of Fish and Game, Juneau, Alaska.

Boertje, R.D., P. Valkenburg, and M.E. McNay. 1996. Increase in Moose, Caribou, and Wolves Following Wolf Control in Alaska. *Journal of Wildlife Management*, 60:474-489.

Boggs, K. 1997. Classification of Community Types, Successional Sequences, and Landscapes of the Copper River Delta, Alaska. General Technical Report. U.S. Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Bogoslovskaya, L.S., L.M. Votrogov, and I.I. Krupnik. 1982. The Bowhead Whale off Chukotka: Migrations and Aboriginal Whaling. Report of the International Whaling Commission. 32:391-399.

Bohn, M.S., and C.B. Benham. 1999. Coal-to-Liquids via Fischer-Tropsch Synthesis. Twenty-fourth Industrial Technical Conference on Coal Utilization. Clearwater, Florida.

Borba, B.M., and H.M. Hammer. 1996. Subsistence and Personal Use Salmon Harvest Estimates, Yukon Area, 1995. Division of Commercial Fisheries, Alaska Department of Fish and Game, Regional Information Report 3A96-28.

Boreal Partners in Flight Working Group. 1999. Land Conservation Plan for Alaska Biogeographic Regions. Version 1.0. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Bos, G.N. 1975. A Partial Analysis of the Current Population Status of the Nelchina Caribou Herd. Pages 170-180 *in:* Proceedings of the International Reindeer and Caribou Symposium.

Boudreau, T.A. 1996. Game Management Units 20A, 20B, 20C and 20F, Central-Lower Tanana River Drainage. Pages 139-152 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities July 1 1992 – June 30 1995. Black Bear. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1 through W-24-3, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

Boudreau, T.A. 1997. Game Management Unit 25C, 20B and 20F White Mountains Caribou Herd. Pages 197-207 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities, 1 July 1994 – 30 June 1996. Caribou. Federal Aid in Wildlife Restoration, Grants W-24-3 and W-24-4, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Bowers, P.M. 1982. The Lisburne Site: Analysis and Cultural History of a Multi-Component Lithic Workshop in the Iteriak Valley, Arctic Foothills, Northern Alaska. *in:* E.S. Hall, Jr. and R.Gal, (eds.). Archaeological Investigations by the U.S. Geological Survey and Bureau of Land Management in the National Petroleum Reserve in Alaska. Anthropological Papers of the University of Alaska, 20(1–2):79–112.

Bowers, P.M. 1983. A Status Report on the Gallagher Flint Station National Historic Landmark: Bureau of Land Management, Arctic Resource Area.

Bowers, P.M. 1999. AMS Dating of the Area 22 American PaleoArctic Tradition Microblade Component at the Lisburne Site, Arctic Alaska. Accepted for publication in *Current Research in the Pleistocene*, Vol. 16.

Bowers, P.M. and Gannon, B.L. 1998. Historical Development of the Chena River Waterfront, Fairbanks, Alaska: an Archaeological Perspective. Report to the Alaska Department of Transportation and Public Facilities, and the Federal Highway Administration. Northern Land Use Research, Inc., Fairbanks, Alaska, and Hart Crowser, Inc., Anchorage, Alaska.

BP Exploration (Alaska) Inc. Annual. Exploration in Alaska. Anchorage, Alaska.

BPXA. 1999. Guns and Weapons Procedure. BP Exploration (Alaska) Inc. Anchorage, Alaska.

Bradner, T. 2000. Pipeline Facts are Needed. *Anchorage Daily News*, Sept 10, 2000.

Bridges, J.M., M. Barger, N. Chevance, T. Anderson, J. Holt, R. Jones, and E. Nelson. 1997. Environmental Impacts Associated with Routine Transmission Line Maintenance. Pages 19-24 *in:* Williams et al., (eds.). Proceedings of the Sixth International Symposium on Environmental Concerns in Rights-of-Way Management, 24-26 February 1997. New Orleans, Louisiana.

Bright, L. 1999. U.S. Fish and Wildlife Service, personal communication, October 30, 1999.

Britton, M.E. 1957. Vegetation of the Arctic Tundra. Pages 26-72 *in:* H.P. Hansen (ed.). Arctic Biology. Oregon State University Press, Corvallis, Oregon.

Brna, P. 1999. Joint Pipeline Office, personal communication.

Brooks J.W. 1954. A Contribution to the Life History and Ecology of the Pacific Walrus. Alaska Cooperative Wildlife Research Unit, University of Alaska, Fairbanks, Special Report 1. 103 pp.

Brosted, J. 1975. Ulgunik: A Report on Integration and Village Organization in Alaska. Mimeographed.

Brower, H., Sr. Various. Life-long resident of Barrow, whaling captain and hunter, personal communication, numerous occasions between 1963 and 1990.

Brower, H.K., Jr., and R.T. Opie. 1996. North Slope Borough Subsistence Harvest Documentation Project: Data for Anaktuvuk Pass, Alaska for the Period July 1, 1994 to June 30, 1995. North Slope Borough, Department of Wildlife Management, Barrow, Alaska.

Brower, H.K., Jr., and R.T. Opie. 1997. North Slope Borough Subsistence Harvest Documentation Project: Data for

Anaktuvuk Pass, Alaska for the Period July 1, 1994 to June 30, 1995. North Slope Borough, Department of Wildlife Management, Barrow, Alaska.

Brower, H.K., Jr., and R.T. Opie. 1997a. North Slope Borough Subsistence Harvest Documentation Project: Data for Nuiqsut, Alaska for the Period July 1, 1994 to June 30, 1995. North Slope Borough, Department of Wildlife Management, Barrow, Alaska.

Brown, D. 1999. Security/Alyeska Pipeline Service Company, personal communication, November 1, 1999.

Brown, J. 1968. An Estimation of the Volume of Ground Ice, Coastal Plain, Northern Alaska. Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Brown, J. 1980. The Road and Its Environment. *in:* J. Brown and R. L. Berg (eds.). Environmental Engineering and Ecological Baseline Investigations Along the Yukon River-Prudhoe Bay Haul Road. CRREL Report 80-19. U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Brown, J., and N.A. Grave. 1979. Physical and Thermal Disturbance and Protection of Permafrost. Pages 51-91 *in:* Proceedings of the Third International Conference on Permafrost, Vol. 2. National Research Council of Canada, Ottawa, Ontario, Canada.

Brown, J., and P.V. Sellmann. 1973. Permafrost and Coastal Plain History of Arctic Alaska. *in:* M.E. Britton (ed.). Alaskan Arctic Tundra. Arctic Institute of North America, Calgary, Alberta, Canada.

Brown, J., and R.A. Kreig. 1983. Guidebook to Permafrost and Related Features, Elliot and Dalton Highways, Fox to Prudhoe Bay, Alaska. Alaska Division of Geological and Geophysical Surveys.

Brown, J., O.J. Ferrians, J.A. Heginbottom, and Melnkov. 1997. Circum-Arctic Map of Permafrost and Ground Ice Conditions. U.S. Geological Survey, Map CP-45. U.S. Geological Survey.

Brown, J., P.C. Miller, L.L. Tieszen, and F.L. Bunell. 1980. An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska. US/IBP Synthesis Series 12. Dowden, Hutchinson, and Ross, Inc. Stroudsberg, Pennsylvania.

Brown, J., F. Nelson, B. Brockett, S.I. Outcalt, and K.R. Everett. 1983. Observations on Ice-cored Mounds at Sukakpak Mountain, South-central Brooks Range, Alaska. Pages 91-96 *in:* Permafrost Fourth International Conference Proceedings, University of Alaska. National Academy Press, Washington, D. C.

Brown, W.E. 1979. Nuiqsut Paisanich: Nuiqsut Heritage, A Cultural Plan. Prepared for the Village of Nuiqsut and the North Slope Borough Planning Commission on History and Culture. University of Alaska, Arctic Environmental Information and Data Center, Anchorage, Alaska.

Burch, E.S. 1975. Eskimo Kinsmen: Changing Family Relationships in Northwest Alaska. American Ethnological Society Monograph No. 59. West Publishing Co., St. Paul, Minnesota.

Burch, E.S. 1998. The Inupiaq Eskimo Nations of Northwest Alaska. University of Alaska Press, Fairbanks, Alaska.

Burger, A.E., and D.M. Fry. 1993. Effects of Oil Pollution on Seabirds in the Northeast Pacific. Pages 225-263 *In*: K. Vermeer, K.T. Briggs, K.H. Morgan, and D. Siegal-Causey (eds.). The Status, Ecology, and Conservation of Marine Birds of the North Pacific. CW66-124-1993E. Canadian Wildlife Service. Ottawa, Ontario, Canada.

Burger, C., and L. Swenson. 1977. Environmental Surveillance of Gravel Removal on the Trans-Alaska Pipeline System with Recommendations for Future Gravel Mining. Special Report No. 13. Joint State/Federal and Fish and Wildlife Advisory Team.

Burgess, M.M., S.E. Grechischev, P.J. Kurfurst, E.S. Melnikov, and N.G. Moskalenko. 1993. Monitoring of Engineering-Geological Processes Along Pipeline Routes in Permafrost Terrain in Mackenzie River Valley, Canada and Nadym Area, Russia. Pages 54-59 *in:* Permafrost Proceedings Sixth International Conference. South China University of Technology Press, Wushan Guangzhou, China.

Burgess, R.M. 2000. Arctic Foxes. Chapter 8 *in:* J. Truett and S. R. Johnson, (eds.). The Natural History of an Arctic Oil Field. Academic Press, San Diego, California.

Burgess, R.M., and P.W. Banyas. 1993. Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992. Prepared by Alaska Biological Research, Inc. Report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Burgess, R.M., and R.J. Ritchie. 1987. Snow Goose. 1985 Endicott Environmental Monitoring Program. Volume 7, Part VII. Report prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska, by Envirosphere Company, Anchorage, Alaska.

Burgess, R.M., and R.J. Ritchie. 1990. Snow Goose. 1986 Endicott Environmental Monitoring Program. Volume 8, Part VI, Chapter 1. Report prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska, by Envirosphere Company, Anchorage, Alaska.

Burgess, R.M., and R.J. Ritchie. 1991. Snow Goose. 1987 Endicott Environmental Monitoring Program. Volume 8, Part V, Chapter 1. Report prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska, by Envirosphere Company, Anchorage, Alaska.

Burgess, R.M., and J.R. Rose. 1993. Snow Goose. 1992 Endicott Environmental Monitoring Program. Unpublished draft report prepared by Science Applications International Corp. Prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Burgess, R.M., T.C. Cater, M.T. Jorgenson, and B.A. Anderson. 1995. Ecological Impact Assessment and Restoration Options for the Pt. McIntyre Oil Spill. Prepared by

ABR, Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Burgess, R.M., M.T. Jorgenson, T.C. Cater, B.A. Anderson, L.L. Jacobs, and B.E. Lawhead. 1995. Ecological Impact Assessment and Restoration Options for the DS-5 Oil Spill, Prudhoe Bay, Alaska, 1994. Draft report prepared by ABR, Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Burgess, R.M., J.R. Rose, P.W. Banyas, and B.E. Lawhead. 1993. Arctic Fox Studies in the Prudhoe Bay Unit and Adjacent Undeveloped Areas, 1992. Northern Alaska Res. Studies report. Prepared by Alaska Biological Research, Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Burgess, R.M, A.A. Stickney, J.R. Rose, and R.J. Ritchie. 1992. Snow Goose Monitoring Program, 1990 Endicott Development Project. Final report to SAIC, Inc., for U.S. Army Corps of Engineers, Anchorage, Alaska.

Burgess, R.M. 1999. Senior Research Biologist, ABR, Inc., personal communication, October 1999.

Burns, J.J. 1967. The Pacific Bearded Seal. Alaska Department of Fish and Game, Juneau, Alaska. 66 pp.

Burns, J.J., and K.J. Frost. 1983. The Natural History and Ecology of the Bearded Seal, *Erignathus barbatus*. OCSEAP Final Report 19:311-392. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration.

Burns, J.J., and S.J. Harbo, Jr. 1972. An Aerial Census of Ringed Seals, Northern Coast of Alaska. *Arctic* 25(4):279-290.

Burns, J.J., and G.A. Seaman. 1985. Investigations of Belukha Whales in Coastal Waters of Western and Northern Alaska II. Biology and Ecology. Outer Continental Shelf Environmental Assessment Program, 1988 Final Reports.

Burris, O.E., and D.E. McKnight. 1973. Game Transplants in Alaska. Game Technical Bulletin Number 4. Federal Aid in Wildlife Restoration Project W-17-R. Alaska Department of Fish and Game, Juneau, Alaska.

Buskirk, S.W. 1983. The Ecology of Marten in Southcentral Alaska. Ph.D. dissertation, University of Alaska, Fairbanks, Alaska.

Buskirk, S.W., and S.W. MacDonald. 1984. Seasonal Food Habits of Marten in South-central Alaska. *Canadian Journal of Zoology*, 62:944-950.

Butler, R.G., A. Harfenist, F.A. Leighton, and D.B. Peakall. 1988. Impact of Sublethal Oil and Emulsion Exposure on the Reproductive Success of Leach’s Storm Petrels: Short and Long Term Effects. *Journal of Applied Ecology* 25:125-143.

Buzzell, R.G. 1995. Shepard Point Road Cultural Resources Survey, Cordova, Alaska (Project No. 65928). Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, Office of History and Archaeology.

Byrd, G.V., E.P. Bailey, and W. Stahl. 1996. Introduced Predator Removal from Islands. EVOS restoration project final report. Rest. Proj. 95041. U.S. Fish and Wildlife Service, Homer, Alaska. 37 pp.

Cade, T.J. 1960. Ecology of the Peregrine and Gyrfalcon populations in Alaska. *University of California Publication in Zoology*, 63:151–290.

Calef, G.W., E.A. DeBock, and G.M Lortie. 1976. The Reaction of Barren-ground Caribou to Aircraft. *Arctic*, 29:201-212.

Calkins, D.G. 1978. Feeding Behavior and Major Prey Species of the Sea Otter, *Enhydra lutris*, in Montague Strait, Prince William Sound, Alaska. *Fishery Bulletin*, 76:125-132.

Calkins, D.G. 1986. Marine Mammals. Pages 527–558 *in:* D.W. Hood and S.T. Zimmerman (eds.). The Gulf of Alaska, Physical Environment and Biological Resources. Government Printing Office, Washington, D. C.

Calkins, D.G., and E. Goodwin. 1988. Investigations of the Declining Sea Lion Population of the Gulf of Alaska. National Marine Mammal Laboratory contract NA-ABH-00029. Alaska Department of Fish and Game, Anchorage, Alaska.

Calkins, D.G., and K.W. Pitcher. 1982. Population Assessment, Ecology, and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska. Environmental Assessment of Alaskan Continental Shelf, Final Reports 19:445-546.

Calkins, D.G., and K.B. Schneider. 1985. The Sea Otter (*Enhydra lutris*). Pages 37-45 *in:* J.J. Burns, K.J. Frost, and L.F. Lowry (eds.). Marine Mammal Species Accounts. Game Technical Bulletin No. 7, Alaska Department of Fish and Game, Juneau, Alaska.

Calkins, D.G., E. Becker, T.R. Spraker, and T.R. Loughlin. 1994. Impacts on Steller Sea Lions. Pages 119-139 *in:* T.R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Cameron, R.D. 1993. Distribution and Productivity of the Central Arctic Caribou Herd in Relation to Petroleum Development: Case History Studies with a Nutritional Perspective. Federal Aid in Wildlife Restoration Research Progress Report, Project W-24-1, Study 3.35. Alaska Department of Fish and Game.

Cameron, R.D. 1994. Reproductive Pauses By Female Caribou. *Journal of Mammalogy*, 75:10-13.

Cameron, R.D. 1995. Can Petroleum Development Depress the Productivity of Arctic Caribou? Page 36 *in:* Proceedings of the Second International Arctic Ungulate Conference, Fairbanks, Alaska, 13-17 August 1995. (abstract)

Cameron, R.D., and K.R. Whitten. 1979. Seasonal Movements and Sexual Aggregation of Caribou Determined by Aerial Survey. *Journal of Wildlife Management*, 43:626-633.

Cameron, R.D., and K.R. Whitten. 1980. Distribution and Movements of Caribou in Relation to the Kuparuk Development Area, Second Interim Report. Alaska Department of Fish and Game, Fairbanks, Alaska.

Cameron, R.D., and K.R. Whitten. 1980a. Influence of the

Trans-Alaska Pipeline Corridor on the Local Distribution of Caribou. Pages 475-484 *in:* E. Reimers, E. Gaare, and S. Skjenneberg, (eds.). Proceedings of the Second International Reindeer/Caribou Symposium, 1979, Norway.

Cameron, R.D., E.A. Lenart, D.J. Reed, K.R. Whitten, and W.T. Smith. 1995. Abundance and Movements of Caribou in the Oilfield Complex Near Prudhoe Bay, Alaska. *Rangifer,* 15:3-7.

Cameron, R.D., D.J. Reed, J.R. Dau, and W.T. Smith. 1992. Redistribution of Calving Caribou in Response to Oil Field Development on the Arctic Slope of Alaska. *Arctic,* 45:338-342.

Cameron, R.D., W.T. Smith, S.G. Fancy, K.L. Gerhart, and R.G. White. 1993. Calving Success of Female Caribou in Relation to Body Weight. *Canadian Journal of Zoology,* 71:480-486.

Cameron, R.D., K.R. Whitten, and W.T. Smith. 1985. Effects of the Trans-Alaska Pipeline Corridor on the Distribution and Movements of Caribou. Federal Aid in Wildlife Restoration Final Report. Project W-17-7 through W-17-1, W-21-1, W-21-2, and W-22-1 through W-22-4, Study 3.18R. Alaska Department of Fish and Game.

Cameron, R.D., K.R. Whitten, W.T. Smith, and D.D. Roby. 1979. Caribou Distribution and Group Composition Associated with Construction of the Trans-Alaska Pipeline. *Canadian Field-Naturalist,* 93:155-162.

Campbell, B.H., and M. Hinkes. 1983. Winter Diets and Habitat Use of Alaska Bison After Wildfire. *Wildlife Society Bulletin,* 11:16-21.

Campbell, J. 1995. Arsenal of Democracy. *Alaska Geographic,* 22(4):4–45.

Campbell, J.M. 1973. Archaeological Studies Along the Proposed Trans-Alaska Oil Pipeline Route. Technical Publication 26. Arctic Institute of North America, Calgary, Alberta, Canada.

Campbell, J.M. 1974. Effects of Late Prehistoric and Early Historic Eskimo Hunting of Dall Sheep in North Alaska: Examples of Aboriginal Overkill. Pages 108-126 *in:* Proceedings of the Northern Wild Sheep and Goat Council. Montana Department of Fish and Game.

Cannon, T.C., B.A. Adams, D. Glass, and T. Nelson. 1987a. Fish Distribution and Abundance. Pages 1-38 *in:* Endicott Environmental Monitoring Program, Final Reports, 1985. Vol. 6. Unpublished report prepared by Envirosphere Company. Available at U.S. Army Corps of Engineers, Anchorage, Alaska.

Cargill, S.A., and F.S. Chapin, III. 1987. Application of Successional Theory to Tundra Restoration: A Review. *Arctic and Alpine Research,* 19(4):366-372.

Carr, B. 1999. Manager of Operations/Alaska Railroad Corporation, personal communication, November 22, 1999.

Carroll, G. 1995. Teshekpuk Lake Herd. Pages 200-208 *in:* M.V. Hicks (ed.). Caribou. Management Report of Survey-inventory Activities, 1 July 1992-30 June 1994. Federal Aid in Wildlife Restoration, Grants W-24-2 and W-24-3, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Carroll, G. 1995a. Game Management Unit 26A. Pages 289-303 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities, 1 July, 1992-30 June, 1994. Federal Aid in Wildlife Restoration Grants W-24-1 and W-24-2, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Carruthers, D.R., and R.D. Jakimchuk. 1987. Migratory Movements of the Nelchina Caribou Herd in Relation to the Trans-Alaska Pipeline. *Wilderness Society Bulletin,* 15:414-420.

Carruthers, D.R., S.H. Ferguson, and L.G. Sopuck. 1987. Distribution and Movements of Caribou, *Rangifer tarandus,* in the Central Arctic Region of Alaska. *Canadian Field-Naturalist,* 101:423-432.

Carruthers, D.R., R.D. Jakimchuk, and S.H. Ferguson. 1984. The Relationship Between the Central Arctic Caribou Herd and the Trans-Alaska pipeline. Prepared by Renewable Resources Consulting Services, Ltd., Sydney, B.C., Canada. Prepared for Alyeska Pipeline Service Company.

Carson, C.E., and K.M. Hussey. 1961. The Oriented Lakes of Arctic Alaska. *Journal of Geology,* 70:417-439.

Case, D. 1984. Alaska Natives and American Laws. University of Alaska Press, Fairbanks, Alaska.

Case, D. 1989. Subsistence and Self-Determination: Can Alaska Natives Have a More “Effective Voice?” *University of Colorado Law Review,* 60(4):24.

Case, R., and J. Stevenson. 1991. Observation of Barren-ground Grizzly Bear, *Ursus arctos,* Predation on Muskoxen, *Ovibos moschatus,* in the Northwest Territories. *Canadian Field Naturalist,* 105:105-106.

Castner, J.C. 1900. A Story of Hardship and Suffering in Alaska. *in:* Compilation of Narratives of Explorations in Alaska. Government Printing Office, Washington, D.C.

Cater, T.C., L.J. Rossow, and M.T. Jorgenson. 1996. Long-term Ecological Monitoring of Tundra Affected by a Crude Oil Spill Near Drill Site 2U, Kuparuk Oilfield, Alaska, 1996. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Caulfield, R., and T. Brelsford. 1991. Alaska: Subsistence Policy History, Vol. 1999. NativeNet.

Caulfield, R.A. 1981. Final Report of the Survey of Permitholders in the Tanana River Subsistence Salmon Permit Fishery 1981. Technical Paper 14. Alaska Department of Fish and Game, Fairbanks, Alaska.

Cederquist, S. 1999. The Trans-Alaska Pipeline System: A Multi-Component Approach to Cathodic Protection Monitoring. Materials Performance (NACE), November 1999.

CEQ. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President, Washington, D.C.

CERA. 1999a. White Paper, Alaskan Natural Gas. Cambridge Energy Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

CERA. 1999d. White Paper, Access to North Slope Facilities. Cambridge Energy Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Chance, N. 1966. The Eskimo of North Alaska. Holt, Rinehart, and Winston, New York.

Chance, N. 1990. The Inupiat and Arctic Alaska: An Ethnography of Development. Holt, Rinehart and Winston, New York.

Chance, N.A. 1970. Directed Change and Northern Peoples. *in:* G.W. Rogers (ed.). *Change in Alaska, People, Petroleum, and Politics.* University of Alaska Press, College, Alaska.

Chapin, F.S. III., and G.R. Shaver. 1985. Individualistic Growth Response of Tundra Plant Species to Manipulation of Light, Temperature, and Nutrients in a Field Experiment. *Ecology,* 66:564-576.

Chapin, F.S. III., P.C. Miller, W.D. Billings, and P.J. Coyne. 1980. Carbon and Nutrient Budgets and Their Control in Coastal Tundra. Pages 458-484 *in:* J. Brown, P.C. Miller, L.L. Tieszen, and F.L. Bunell (eds.) An Arctic Ecosystem: The Tundra at Barrow, Alaska. Dowden, Hutchinson, and Ross, Stroudsberg, Pennsylvania.

Chappel, R. 1987. Coast Guard Takes Over Oil Spill Cleanup 125,000 gallons Foul Inlet; Fishermen Wait. Page A1 *in: Anchorage Daily News*, July 9, 1987.

Chesemore, D.L. 1975. Ecology of the Arctic Fox in North America — A Review. Pages 143-163 *in:* M.W. Fox (ed.). The Wild Canids. Van Nostrand-Reinhold, New York.

Child, K.N., S.P. Barry, and D.A. Aitken. 1991. Moose mortality on highways and railways in British Columbia. *Alces,* 27:41-49.

Childers, J.M. 1975. Hydrologic Environment of the Trans-Alaska Pipeline System (TAPS), Alaska. Pages 39-40 *in:* M.E. Yount (ed.). U.S. Geological Survey Alaska Program 1975, Circular C 0722.

Childers, J.M., J.W. Nauman, D.R. Kernodle, and P.F. Doyel. 1978. Water Resources Along the TAPS Route 1970-1974, Open-File Report OF 78-137, p. 143.

Cicchetti, C.J. 1972. Alaskan Oil Alternative Routes and Markets. Johns Hopkins University Press, Baltimore, Maryland.

City of Valdez. 1992. Valdez Coastal Management Program. Valdez, Alaska: The City. Community Development Department, Valdez, Alaska.

Clark, M. 1999. Oil Critics Demand Safer Tankers. *Anchorage Daily News*. Metro Section, pg B1, March 22, 1999.

Clark, T.W., E. Anderson, C. Douglas, and M. Strickland. 1987. *Martes americana*. Mammalian Species No. 289, American Society of Mammalogists.

Clarkson, P.L., and I.S. Liepins. 1993. Grizzly Bear, *Ursus arctos*, Predation on Muskox, *Ovibos moschatus*, Calves Near the Horton River, Northwest Territories. *Canadian Field Naturalist,* 107:100-102.

Cluff, L.S., D.B. Slemmons, G.E. Brogan, and M.K. Korringa. 1974. Summary Report, Basis for Pipeline Design for Active-Fault Crossings for the Trans-Alaska Pipeline System, Appendix A-3.1111. Prepared by Woodward-Lundgren and Associates, Houston, Texas, for Alyeska Pipeline Service Company, Anchorage, Alaska.

Coady, J.W. 1980. History of Moose in Northern Alaska and Adjacent Regions. *Canadian Field-Naturalist,* 94:61-68.

Coates, P.A. 1993. The Trans-Alaska Pipeline Controversy Technology, Conservation, and the Frontier. University of Alaska Press.

Cobb, E.H. 1973. Placer Deposits of Alaska. Pages 123-124 *in:* U.S. Geological Survey Bulletin 1374.

Cole, D. 1997. Amazing Pipeline Stories, How Building the Trans-Alaska Pipeline Transformed Life in America's Last Frontier. Epicenter Press, Fairbanks, Alaska.

Cole, D. 1999. Fairbanks: A Gold Rush Town that Beat the Odds. Epicenter Press, Fairbanks, Alaska.

Cole, T. 1981. E.T. Barnette: The Strange Story of the Man Who Founded Fairbanks. Alaska Northwest Publishing Company, Anchorage, Alaska.

Cole, H., V. Colonell, and D. Esch, D. 1999. The Economic Impact and Consequences of Global Climate Change on Alaska's Infrastructure. University of Alaska Fairbanks Center for Global Change and Arctic System Research, Proceeding of a Workshop - Assessing the Consequences of Climate Change for Alaska and the Bering Sea Region.

Colescott, J.H., and M.P. Gillingham. 1998. Reaction of Moose (*Alces alces*) to Snowmobile Traffic in the Greys River Valley, Wyoming. *Alces,* 34:329-338.

Collins, W.B. 1999. Interrelationships of Forage and Moose in Game Management Unit 13. Federal Aid in Wildlife Restoration Research Progress Report Grant W-27-1, Study 1.50. Alaska Department of Fish and Game, Juneau, Alaska.

Colonell, J.M. 1980. Port Valdez, Alaska: Environmental Studies 1976-1979. Pages 11-35 *in:* Institute of Marine Science, Occasional Publication No. 5. Institute of Marine Science, University of Alaska, Fairbanks. December, 1980.

Colonell, J.M., and B.J. Gallaway. 1997. Wind-driven Transport and Dispersion of Age-0 Arctic Cisco Along the Beaufort Sea Coast. American Fisheries Society Symposium 19:90-103. American Fisheries Society, Bethesda, Maryland.

Colt, S. 1991. Financial Performance of Native Regional Corporations, Alaska Review of Social and Economic Conditions. ISER.

Comins, D. 1999. Alyeska Pipeline Service Company, personal communication.

Committee on OPA 90. 1998. Double-Hull Tanker Legislation: An Assessment of the Oil Pollution Act of 1990. Marine Board, Commission on Engineering and Technical Systems, National Research Council, Committee on Oil Pollution Act of 1990 (Section 4115) Implementation Review. National Academy Press, Washington, D.C.

Conant, B., J.I. Hodges, D.J. Groves, and J.G. King. 1996. Alaska Trumpeter Swan Status Report — 1995. Unpublished report by U.S. Fish and Wildlife Service, Migratory Bird Management, Juneau, Alaska.

CONCAWE. 1998. Western European Cross-Country Oil Pipelines 25-year Performance Statistics. Conservation of Clean Air and Water in Europe, Brussels, Belgium.

Condon, W.L., J.T. Shively, and B.M. Botelho. 1998. Alaska North Slope Gas Commercialization Team, Report to the Governor. January 7, 1998.

Connors, P.G., J.P. Myers, and F.A. Pitelka. 1979. Seasonal Habitat Use by Arctic Alaskan Shorebirds. *Studies in Avian Biology,* 2:101-111.

Consiglieri, L.D., and H.W. Braham. 1982. Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska. Research Unit 68. Partial Final Report Submitted to National Oceanographic and Atmospheric Administration, Alaska Outer Continental Shelf Environmental Assessment Program, Juneau, Alaska.

Cook, J.A., C.J. Conroy, and J.D. Herriges, Jr. 1997. Northern Record of the Water Shrew, *Sorex palustris*, in Alaska. *Canadian Field-Naturalist,* 111:638-640.

Cook, J.P. 1969. The Early Prehistory of Healy Lake, Alaska. Ph.D. dissertation, University of Wisconsin, Madison.

Cook, J.P. (ed.). 1970. Report of Archaeological Survey and Excavations Along the Alyeska Pipeline Service Company Haulroad and Pipeline Alignments. University of Alaska, Fairbanks, Alaska.

Cook, J.P. (ed.). 1971. Final Report of the Archaeological Survey and Excavations Along the Alyeska Pipeline Service Company Pipeline Route. University of Alaska, Fairbanks.

Cook, J.P. 1975. Archaeology of Interior Alaska. *Western Canadian Journal of Anthropology*, 5:125–133.

Cook, J.P. (ed.). 1977. Pipeline Archaeology: Archaeological Investigations Along the Trans-Alaska Pipeline. Institute of Arctic Biology, University of Alaska, Fairbanks.

Cookenboo, L., Jr. 1955. Crude Oil Pipe Lines and Competition in the Oil Industry. Harvard University Press, Cambridge, Massachusetts.

Cooper, C.D. and F.C. Alley. 1994. Air Pollution Control, A Design Approach. Waveland Press.

Cooper, B.A., R.J. Ritchie, B.A. Anderson, and L.C. Byrne. 1991. Alaska Over-the-Horizon Backscatter Radar System: A Synthesis of the Avian Research Program, 1987–1990. Prepared by Alaska Biological Research, Inc. Prepared for Arctic Environmental Information and Data Center, Anchorage, Alaska and U.S. Air Force, Hanscom AFB, Massachusetts.

Cooper, B.A., R.J. Ritchie, B.A. Anderson, and C.L. Cranor. 1988. OTH-B Avian Survey Field Program—Spring 1988. Prepared by Alaska Biological Research, Inc. Prepared for Metcalf and Eddy/Holmes and Narver, Wakefield, Massachutes, and SRI International, Menlo Park, California.

Cooper, D.J. 1986. Arctic-alpine Tundra Vegetation of the Arrigetch Creek Valley, Brooks, Range, Alaska. *Phytocoenologia*, 14:467-555.

Cooper, W.S. 1942. Vegetation of the Prince William Sound Region, Alaska; with a Brief Excursion into Post-pleistocene Climatic History. *Ecological Monographs*, 12:3-22.

Copper Valley Economic Development Council, Inc. 1992. Copper River Region Resource Inventory and Community Profiles. Glennallen, Alaska.

Corbin, J. 1971. Aniganigarak (S-67): A Contact Period Nunamiut Eskimo Village in the Brooks Range. Pages 276-296 *in:* J.P. Cook (ed.). Final Report of the Archaeological Survey and Excavations Along the Alyeska Pipeline Service Company Route. University of Alaska, Fairbanks.

Corbin, J. 1975. The Aniganigaruk Site. Ph.D. dissertation, Washington State University, Pullman, Washington.

Cornelius, D. 1978. The Coyote in Alaska. Wildlife Notebook Series. Alaska Department of Fish and Game, Juneau, Alaska.

Cosens, S.E., and L.P. Dueck. 1993. Icebreaker Noise in Lancaster Sound, N.W.T., Canada: Implications for Marine Mammal Behaviour. *Marine Mammal Science* 9(3):285-300.

Côte, S.D. 1996. Mountain Goat Responses to Helicopter Disturbance. *Wildlife Society Bulletin,* 24:681-685.

Council of Economic Advisors. 1998. Economic Report of the President. Government Printing Office, Washington, D.C.

Cowan, I.M. 1944. The Dall Porpoise, *Phocoenoides dalli* (True), of the Northern Pacific Ocean. *Journal of Mammalogy,* 25:295–306.

Cowan, I.M. 1949. Rabies as a Possible Population Control of Arctic Canidae. *Journal of Mammalogy,* 30:396-398.

Crabtree, A.F., and J. Roseberry. 1981. Mitigation of Pipeline and Transmission Line Impacts. Pages 21-1 – 21-5 *in:* Proceedings of the Second Symposium of Environmental Concerns in Rights-of-Way Management, October 16-18, 1979. Ann Arbor, Michigan.

Craig, P.C. 1977a. Ecological Studies of Amphidromous and Resident Populations of Arctic Char in the Canning River Drainage and Adjacent Coastal Waters of the Beaufort Sea, Alaska. Arctic Gas Biological Report Series 41.

Craig, P.C. 1977b. Fisheries Research in the Shaviovik Drainage, Alaska, with Emphasis on Arctic Char in the Kavik River. Arctic Gas Biological Report Series 41.

Craig, P.C. 1984. Fish Use of Coastal Waters of the Alaskan

Beaufort Sea: A Review. *Transactions of the American Fisheries Society,* 113:265-282.

Craig, P.C. 1989a. Subsistence Fisheries at Coastal Villages in the Alaskan Arctic, 1970-1986. Biological Papers of the University of Alaska No. 24:131-152.

Craig, P.C. 1989b. An Introduction to Anadromous Fishes in the Alaskan Arctic. Biological Paper University of Alaska No. 24:27-54.

Craig, P.C., and L. Haldorson. 1981. Beaufort Sea Barrier Island-lagoon Ecological Processes Studies: Final Report, Simpson Lagoon (Part 4, Fish). Vol. 7. Pages 384-678 *in:* Environmental Assessment of the Alaskan Continental Shelf. Bureau of Land Management and National Oceanographic and Atmospheric Administration (OCSEAP), Boulder, Colorado.

Craig, P.C., and G.J. Mann. 1974. Life History and Distribution of Arctic Cisco (*Coregonus autumnalis*) Along the Beaufort Sea Coastline in Alaska and the Yukon Territory. Arctic Gas Biological Report Series 20.

Craig, P.C., and P. McCart. 1974. Fall Spawning and Overwintering Areas of Fish Populations Along Routes of Proposed Pipeline Between Prudhoe Bay, Alaska, and the Mackenzie Delta. Arctic Gas Biological Report Series 15.

Craig, P.C., and P. McCart. 1975. Classification of Stream Types in Beaufort Seas Drainages Between Prudhoe Bay, Alaska, and the Mackenzie Delta, Northwest Territory. *Arctic and Alpine Research,* 7:183-198.

Craighead, J.J. 1980. A Proposed Delineation of Critical Grizzly Bear Habitat in the Yellowstone Region. Bear Biological Association Monograph Series No. 1.

Crandell, R.A. 1975. Arctic Fox Rabies. Pages 23-40 *in:* B.M. Baer (ed.). The Natural History of Rabies. Vol. II. Academic Press, New York.

Critchlow, K.R. 1983. Fish Study. Pages 1–327 *in:* Prudhoe Bay Waterflood Environmental Monitoring Program 1982. Prepared by Woodward–Clyde Consultants. Prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Cronin, M.A., and J.W. Bickham. 1998. A Population Genetic Analysis of the Potential for a Crude Oil Spill to Induce Heritable Mutations and Impact Natural Populations. *Ecotoxicology,* 7:259-278.

Cronin, M.A., S.C. Amstrup, G.M. Durner, L.E. Noel, T.L. McDonald, and W.B. Ballard. 1998. Caribou Distribution During the Post-calving Period in Relation to Infrastructure in the Prudhoe Bay Oil Field, Alaska. *Arctic,* 51:85-93.

Cronin, M.A., W.B. Ballard, J.D. Bryan, B.J. Pierson, and J.D. McKendrick. 1998. Northern Alaska Oil Fields and Caribou: A Commentary. *Biological Conservation,* 83:195-208.

Cronin, M.A., W.B. Ballard, J. Truett, and R. Pollard. 1994. Mitigation of the Effects of Oil Field Development and Transportation Corridors on Caribou (Final Report). Prepared by LGL Alaska Research Associates, Inc. Prepared for the Alaska Caribou Steering Committee, Anchorage, Alaska.

Cronin, M.A., B.J. Pierson, S.R. Johnson, L.E. Noel, and W.B. Ballard. 1997. Caribou population density in the Prudhoe Bay region of Alaska. *Journal of Wildlife Research,* 2:59-68.

Cronin, M.A., L. Renecker, B.J. Pierson, and J.C. Patton. 1995. Genetic Variation in Domestic Reindeer and Wild Caribou in Alaska. *Animal Genetics,* 26:427-434.

Cronin, M.A., R. Shideler, J. Hechtel, C. Strobeck, and D. Paetkau. 1999. Genetic Relationships of Grizzly Bears (*Ursus arctos*) in the Prudhoe Bay Region of Alaska: Inference from Microsatellite DNA, Mitochondrial DNA, and Field Observations. *Journal of Heredity,* 90:622-628.

Cronin, M.A., H.A. Whitlaw, and W.B. Ballard. In press. Northern Alaska Oil Fields and Caribou.*Wildlife Society Bulletin*.

Crow, J.H. 1977. Salt Marshes of Port Valdez, Alaska, and Vicinity. Final report to the Department of the Interior. Newark College of Arts and Sciences, Rutgers University.

Cuccarese, S.V. 1990. Trans-Alaska Pipeline System: A Review of the Environmental Knowledge Base and of Related Policy Matters, Final Report. Prepared by Arctic Environmental Information and Data Center. Prepared for U.S. General Accounting Office, Seattle, Washington.

Curatolo, J.A., and S.M. Murphy. 1986. The Effects of Pipelines, Roads, and Traffic on the Movements of Caribou, *Rangifer tarandus*. *Canadian Field-Naturalist,* 100:218-224.

Curatolo, J.A., and A.E. Reges. 1984. The Calving Ground of the Central Arctic Caribou Herd, 1984. Unpublished report available at Phillips Alaska, Inc., Anchorage, Alaska.

Dabbs, D.L. 1976. Revegetating the North. *Agrologist,* 5(4):28-30.

Dahlheim, M.E., and C.O. Matkin. 1994. Assessment of Injuries to Prince William Sound Killer Whales. Pages 163-171 *in:* T.R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Dale, B.W. 1996a. Game Management Unit 20A, Tanana Flats, Central Alaska Range 1993-1995. Pages 284-298 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-2 and W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Dale, B.W. 1996b. Game Management Unit 20B, Drainages into the North Bank of the Tanana River Between Delta Creek and Manley Hot Springs 1993-1995. Pages 299-311 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-2 and W-24-

3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Dale, B.W. 1997b. Game Management Units 20A, 20B, 20C, 20F and 25C Lower Tanana Valley and Central Yukon Valley. Pages 108-121 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1993 – 30 June 1996. Wolf. Federal Aid in Wildlife Restoration Report, Grants W-24-2 through W-24-4, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Dall, W.H. 1870. Alaska and Its Resources. Lee and Shepard, Boston, Massachusetts.

Dalle-Molle, J., and J. Van Horn. 1991. Observations of Vehicle Traffic Interfering with Migration of Dall's Sheep, *Ovis dalli dalli*, in Denali National Park, Alaska. *Canadian Field-Naturalist,* 105:409-411.

Dalton Highway Advisory and Planning Board. 1998. Dalton Highway Master Plan. Dalton Highway Advisory and Planning Board.

Damas, D. (ed.). 1984. Handbook of North American Indians, Vol. 5, Arctic. Smithsonian Institution, Washington, D.C.

Dau, C.P., and S.A. Kistchinski 1977. Seasonal Movements and Distribution of Spectacled Eider. *Wildfowl,* 28:65–75.

Dau, J. 1997. Game Management Units 21D, 22A, 22B, 23, 24, and 26A Western Arctic Herd. Pages 158-185 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities, 1 July 1994 – 30 June 1996. Caribou. Federal Aid in Wildlife Restoration, Grants W-24-3 and W-24-4, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Dau, J. R. 1986. Distribution and Behavior of Barren-ground Caribou in Relation to Weather and Parasitic Insects. M.S. thesis, University Alaska, Fairbanks.

Dau, J.R., and R.D. Cameron. 1986a. Responses of Barren-ground Caribou to Petroleum Development Near Milne Point, Alaska – Final Report. Prepared by Alaska Department of Fish and Game, Fairbanks. Prepared for Conoco, Inc. and Continental Pipeline Company, Anchorage, Alaska.

Dau, J.R., and R.D. Cameron. 1986b. Effects of a Road System on Caribou Distribution During Calving. *Rangifer,* Special Issue No. 1:95-101.

Daum, D., P. Rost, and M. Smith. 1984. Fisheries Studies on the North Slope of the Arctic National Wildlife Refuge, 1983. Fishery Research Progress Report No. FY84-1. U.S. Fish and Wildlife Service, Fairbanks, Alaska.

Davidson, A. 1974. Education and the Subsistence Way of Life, Vol. 1999. Alaska Native Knowledge Network.

Davidson, A. 1990. In the Wake of the Exxon Valdez, The Devastating Impact of the Alaska Oil Spill. Sierra Club Books, San Francisco, California.

Davis, J.L., and R.E. LeResche. 1978. Fortymile Caribou Herd Studies. Federal Aid in Wildlife Restoration Final Report, Projects W-17-6 and W-17-7. Alaska Department of Fish and Game, Juneau, Alaska.

Davis, J.L., P. Valkenburg, and R.D. Boertje. 1984. Disturbance and the Delta Caribou Herd. Pages 2-6 *in:* A.M. Martell and D.E. Russell (eds.). Proceedings of the First North American Caribou Workshop, September 28-29, 1983, Whitehorse, Yukon Territory, Canada.

Davis, J.L., P. Valkenburg, M.E. McNay, R.O. Beasley, and V.L. Tutterow. 1991. Demography of the Delta Caribou Herd Under Varying Rates of Natural Mortality and Human Harvest, and Assessment of Field Techniques for Acquiring Demographic Data. Federal Aid in Wildlife Restoration, Final Report, Projects W-22-5 through W-23-3. Alaska Department of Fish and Game, Juneau, Alaska.

Davis, N.Y. 1984. Contemporary Pacific Eskimos. D. Damas (ed.). *Arctic,* 5:198–204. Smithsonian Institution, Washington, D.C.

Davis, S. 2000. Oak Ridge National Laboratory, personal communication, June 2000.

Day, R. H. 1998. Predator Populations and Predation Intensity on Tundra-nesting Birds in Relation to Human Development. Final report prepared by ABR, Inc. for U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks, Alaska.

Day, R.H., S.M. Murphy, J.A. Wiens, G.D. Hayward, E.J. Harner, and L.N. Smith. 1995. Use of Oil-Affected Habitats by Birds After the *Exxon Valdez* Oil Spill. Pages 726-761 *in:* P.G. Wells, J.N. Butler, and J.S. Hughes (eds.). *Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, Pennsylvania. 955 pp.

Day, R.H., R.J. Ritchie, and D.A. Flint. 1995. Spectacled and Steller's Eider Surveys at Remote Air Force Sites in Alaska, 1994. Unpublished report prepared by ABR, Inc. Prepared for EA Engineering, Science, and Technology, Redmond, Washington, and The United States Air Force, Elmendorf AFB, Alaska.

Deakin, E.B. 1989. Oil Industry Profitability in Alaska 1969 Through 1987. Alaska Department of Revenue.

Dean, D.A., J.L. Bodkin, S.C. Jewett, D.H. Monson, and D. Jung. 2000. Changes in Sea Urchins and Kelp Following a Reduction in Sea Otter Density as a Result of the *Exxon Valdez* Oil Spill. *Marine Ecology Progress Series* 199:281-291.

DeCicco, A.L. 1985. Inventory and Cataloging of Sport Fish and Sport Fish Waters of Western Alaska with Emphasis on Arctic Char Life History. Annual Report, 1984-1985. Federal Aid in Fish Restoration 26:41-134. Alaska Department of Fish and Game, Juneau, Alaska.

DeCicco, A.L. 1990. Life History of Anadromous Dolly Varden (*S. malma*) in Northwestern Alaska. *in:* Proceedings of the International Society of Arctic Char Fanatics, 16-22 Sept. 1990, Murmansk, Russia.

DeCicco, A.L. 1992. Long-distance Movements of Anadromous Dolly Varden Between Alaska and the USSR. *Arctic*, 45:120-123.

DeCicco, A.L. 1997. Movements of Postsmolt Anadromous Dolly Varden in Northwest Alaska. *American Fisheries Society Symposium*, 19:175-183.

DeGange, A.R., and G.A. Sanger. 1987. Marine Birds. Pages 479-524 *in:* D.W. Wood and S.T. Zimmerman (eds.). The Gulf of Alaska: Physical Environment and Biological Resources. National Oceanic and Atmospheric Administration, and Minerals Management Service, Anchorage, Alaska.

Del Frate, G.G., and T.H. Spraker. 1991. Moose Vehicle Interactions and an Associated Public Awareness Program on the Kenai Peninsula, Alaska. *Alces*, 27:1-7.

Deines, F. 1985. Fox Management Plan, Aleutian Islands Unit, AMNWR. U.S. Fish and Wildlife Service, Adak, Alaska. 10 pp.

Deines, F.G. and B. Willging. 1985. Introduction and Arctic fox Eradication Effort at Kasatochi Island, Aleutian Islands, Alaska, Summer - 1984. U.S. Fish and Wildlife Service, Adak, Alaska. 9 pp.

De Laguna , F. 1956. Chugach Prehistory. University of Washington Publications in Anthropology, No. 13. University of Washington, Seattle, Washington.

De Laguna , F. 1972. Under Mount Saint Elias: The History and Culture of the Yakutat Tlingit. Smithsonian Contributions to Anthropology 7. Washington, D.C.

De Laguna , F., and C. McClellan. 1981. Ahtna. *in:* J. Helm (ed.). Handbook of North American Indians: Subarctic. Vol. 6. Smithsonian Institution, Washington, D.C.

De Laguna , F., F. Riddell, D. McGeein, K. Lande, and J.A. Freed. 1964. Archaeology of the Yakutat Bay Area, Alaska. Smithsonian Institution Bureau of American Ethnology Bulletin 192. Government Printing Office, Washington, D.C.

Delta Junction Chamber of Commerce. 1980. Delta Junction: At the End of the Alaska Highway, p. 32.

Delta Junction Chamber of Commerce. 1999. Delta Junction, Alaska. Web page: www.ptialaska.net/%7eakttt/delta.html

DenBeste, J., and P. McCart. 1984a. Overview of Studies of the Long-term Effects of the Trans-Alaska Pipeline System of Fish and Aquatic Habitats. Volume I. Prepared by Aquatic Environments, Inc. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska.

Deneke, F.J., B.H. McCown, P.I. Coyne, W. Rickard, and J. Brown. 1974. Biological Aspects of Terrestrial Oil Spills: USA CRREL Oil Research in Alaska, 1970-1974. Research Report 346. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Densmore, R.V. 1992. Succession on an Alaskan Tundra Disturbance With and Without Assisted Revegetation With Grass. *Arctic and Alpine Research*, 24:238-243.

Densmore, R.V., and J.C. Zasada. 1978. Rooting Potential of Alaskan Willow Cuttings. *Canadian Journal of Forest Research*, 8(4):477-479.

Densmore, R.V., B.J. Neiland, J.C. Zasada, and M.A. Masters. 1987. Planting Willow for Moose Habitat Restoration on the North Slope of Alaska, USA. *Arctic and Alpine Research*, 19(4):537-543.

Derksen, D.V., K.S. Bollinger, D. Esler, K.C. Jensen, E.J. Taylor, and M.W. Weller. 1990. Effects of Aircraft on Behavior and Ecology of Molting Black Brant Near Teshekpuk Lake, Alaska. Prepared for Bureau of Land Management and Minerals Management Service, Anchorage, Alaska and Department of Wildlife and Fisheries Sciences, Texas A and M University, College Station, Texas.

Derksen, D.V., K.S. Bollinger, D. Esler, K.C. Jensen, E.J. Taylor, M.W. Miller, and M.W. Weller. 1992. Effects of Aircraft on Behavior and Ecology of Molting Black Brant Near Teshekpuk Lake, Alaska. Final report prepared by U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, Anchorage, Alaska, and Department Wildlife Fisheries Sciences, Texas A and M University, College Station, Texas. Prepared for Bureau of Land Management, Fairbanks, Alaska, and Minerals Management Service, Anchorage, Alaska.

Derksen, D.V., T.C. Rothe, and W.D. Eldridge. 1981. Use of Wetland Habitats by Birds in the National Petroleum Reserve–Alaska. Resource Publication 141. U.S. Fish and Wildlife Service, Washington, D.C.

Derry, D.E. 1976. Two-Dimensional Scaling of Dissimilarity Analysis of Six “Denali Complex” Sites in Interior Alaska. Canadian Archaeological Association, Winnipeg, Manitoba, Canada.

Det Norske Veritas, George Washington University, Rensselaer Polytechnic Institute, and LeMoyne College. 1996. Prince William Sound, Alaska Risk Assessment Study, Final Report.

Dickson, L.D. 1994. Nesting Habitat of the Red-throated Loon, *Gavia stellata*, at Toker Point, Northwest Territories. *Canadian Field-Naturalist*, 108:10–16.

Dixon, E.J. 1972. The Gallagher Flint Station, an Early Man Site on the North Slope, Arctic Alaska. Master’s Thesis, University of Alaska, Fairbanks, Alaska.

Dixon, E.J. 1975. The Gallagher Flint Station, An Early Man Site on the North Slope, Arctic Alaska and Its Role in Relation to the Bering Land Bridge. *Arctic Anthropology*, 12(1):68–75.

Dixon, E.J. 1985. Cultural Chronology of Central Interior Alaska. *Arctic Anthropology*, 22(1):47–66.

Dixon, K.R. 1984. Determining the Effects of Rights-of-way on Animal Movement Behavior. Pages 606-613 *in:* A.F. Crabtree (ed.). Proceedings of the Third International Symposium of Environmental Concerns in Rights-of-Way Management, 15-18 February 1982. Published by Mississippi State University.

Dixon, M. 1978. What Happened to Fairbanks? The Effects

of the Trans-Alaska Oil Pipeline on the Community of Fairbanks, Alaska. Social Impact Assessment Series 1. Westview Press, Boulder, Colorado.

DOC. 1972. 1970 Census of Population, Social and Economic Characteristics of Alaska, 1970. U.S. Department of Commerce.

DOC. 1982. 1980 Census of Population, Social and Economic Characteristics of Alaska, 1980. U.S. Department of Commerce.

DOC. 1992. Statistical Abstract of the United States 1992, 112th Edition. U.S. Department of Commerce, Bureau of the Census, Washington, D.C.

DOC. 1993. 1990 Census of Population, Social and Economic Characteristics of Alaska, 1990 cp-2-3. U.S. Department of Commerce.

DOC. 1994. U.S. Exports History 1989-1993: International Harmonized System Commodity Characterization by Country by Customs District. Compact disk edition. U.S. Department of Commerce, Bureau of the Census, Washington, D.C.

DOC. 1997. State and Local Employment and Payroll. From web site: www.census.gov/govs/www.apes97sl.htm. U.S. Department of Commerce, Bureau of the Census.

DOC. 1998. Federal Expenditures by State, Annual. U.S. Department of Commerce, Bureau of the Census.

DOC. 1998a. Full- and Part-time Employment by Census Area, 1997. U.S. Department of Commerce, Bureau of Economic Analysis.

DOC. 1998b. Personal Income by Census Area, 1997. U.S. Department of Commerce, Bureau of Economic Analysis.

DOC. 1999a. U.S. Exports History 1994-1998: International Harmonized System Commodity Characterization by Country by Customs District. Compact disk edition. U.S. Department of Commerce, Bureau of the Census, Washington, D.C.

DOC. 1999b. Statistical Abstract of the United States. U.S. Department of Commerce, Bureau of the Census. From web site: www.census.gov/prod/www/statistical-abstract-us.html.

DOC. 2000. Local Area Personal Income, Personal Income by Major Source and Earnings by Industry. U.S. Department of Commerce, Bureau of Economic Analysis, Regional Account Date. From web site: www.bea.doc.gov/bea/regional/reis/ca05/02/ca05_02185.html.

DOI. 1970. Water Quality Data; Trans Alaska Pipeline Route. U.S. Department of the Interior, Federal Water Pollution Control Administration, Northwest Region Alaska Operations Office.

Dokuchaev, N.E. 1997. A New Species of Shrew (*Soricidae, Insectivora*) from Alaska. *Journal of Mammalogy*, 78:811-817.

Dominske, K.R. 1997. Effects of the Introduction of a Pipeline Right-of-way with Planted Travel Corridors to a Deer Wintering Area in Northern New York. Pages 285-290 *in:* Williams et al., (eds.). Proceedings of the Sixth International Symposium on Environmental Concerns in Rights-of-Way Management, 24-26 February 1997. New Orleans, Louisiana.

Doroff, A.M., and J. L. Bodkin. 1994. Sea Otter Foraging Behavior and Hydrocarbon Levels in Prey. Pages 193-208 *in:* T. R., Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

DOT. 1994. Transportation Statistics Annual Report. U.S. Department of Transportation, Bureau of Transportation Statistics, Washington, D.C.

Doucet, G.J., and Y. Garant. 1997. White-tailed Deer (*Odocoileus virginianus*) Use of Forested Travel Corridors in a Twin 735 kV Powerline Right-of-way – 20 Years of Observations. Pages 299-302 *in:* Williams et al., (eds.). Proceedings of the Sixth International Symposium on Environmental Concerns in Rights-of-Way Management, 24-26 February 1997. New Orleans, Louisiana.

Downs, M.A. 1985. Sociocultural Change and Ethnic Identity: the Effect of the Alaska Native Claims Settlement Act in Unalaska, Alaska. Ph.D. Department of Anthropology, University of California, San Diego, California.

Drury, W.H. 1956. Bog Flats and Physiographic Processes in the Upper Kuskokwim River Region, Alaska. Contributions From the Gray Herbarium of Harvard University No. CLXXVIII.

DuBois, S.D. 1993. Game Management Unit 20D, Central Tanana Valley near Delta. Pages 202-207 *in:* S.M. Abbott (ed.). Management Report of Survey-Inventory Activities. Brown Bear. Federal Aid in Wildlife Restoration Report. Projects W-23-4 and W-23-5, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

DuBois, S.D. 1995. Game Management Unit 20D, Central Tanana Valley near Delta. Pages 213-220 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Brown Bear. Federal Aid in Wildlife Restoration Report. Grants W-24-1 and W-24-2, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

DuBois, S.D. 1996a. Game Management Unit 20D, Central Tanana Valley near Delta Junction 1993-1995. Pages 326-343 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-2 and W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

DuBois, S.D. 1996b. Game Management Units 13B, 20A and 20D, Delta Controlled Use Area. Pages 76-94 *in*: M.V. Hicks (ed.). Management Report of Survey-inventory Activities 1July 1992 - 30 June 1995. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report. Grants W-24-1, W-24-2 and W-24-3, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

DuBois, S.D. 1996c. Game Management Unit 20D, Central Tanana Valley near Delta Junction. Pages 153-158 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities July 1 1992 – June 30 1995. Black Bear. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1 through W-24-3, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

DuBois, S.D. 1998. Game Management Unit 20D, Delta Herd. Pages 25-52 *in:* M.V. Hicks (ed.). Survey-inventory Management Report 1 July 1995 - 30 June 1997. Bison. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-4 and W-24-5, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

DuBois, S.D., and R. Rogers. 1999. Draft Delta Bison Management Plan 1999-2004. Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.

Duffy, L.K., R.T. Bowyer, J.W. Testa, and J.B. Faro. 1996. Acute Phase Proteins and Cytokines in Alaskan Mammals as Markers of Chronic Exposure to Environmental Pollutants. Pages 809-813 *in:* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (eds). Proceedings of the *Exxon Valdez* Oil Spill Symposium. American Fisheries Society Symposium. American Fisheries Society, Bethesda, Maryland.

Duncklee, F. 1999. Maintenance Coordinator/Alyeska Pipeline Service Company, personal communication, July 15, 1999.

Dunton, K.H., and S.V. Schonberg. 2000. The Benthic Faunal Assemblage of the Boulder Patch Kelp Community. *In:* J.C. Truett and S.R. Johnson (eds.). The Natural History of an Arctic Oil Field. Academic Press, San Diego, California. 422 pp.

Dupere & Associates, Inc. 1973. North Slope Borough Reconnaissance Study: An Inventory of the Borough and its Communities. Prepared for the North Slope Borough.

Durtsche, B.M., and W. Hobgood. 1990. Distribution, Movements and Seasonal Use Areas of Caribou in the White Mountains National Recreation Area, Alaska, 1982-1988. Open File Report 29. Bureau of Land Management, Alaska.

Dyer, S.J. 1999. Movement and Distribution of Woodland Caribou (*Rangifer tarandus*) in Response to Industrial Development in Northeastern Alberta. M.Sc. thesis, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada.

Dyrness, C.T., L.A. Viereck, and K. Van Cleve. 1986. Fire in Taiga Communities of Interior Alaska. Pages 74-88 *in:* K. Van Cleve, F.S. Chapin III, P.W. Flanagan, L.A. Viereck and C.T. Dyrness (eds).Forest Ecosystems in the Alaskan Taiga: A Synthesis of Structure and Function. Ecological Studies 57. Springer-Verlag, New York, New York.

Eagan, R.M. 1995. Game Management Unit 20A, Delta Herd. Pages 111-122 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1992 – 30 June 1994. Caribou. Federal Aid in Wildlife Restoration, Grants W-24-2 and W-24-3, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Eagan, R.M. 1996. Game Management Units 20A, 20B, 20C, 20F and 25C, Central and Lower Tanana Valley and Middle Yukon River Drainages. Pages 192-212 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Brown Bear. Federal Aid in Wildlife Restoration Report, Grants W-24-1 and W-24-2, Study 4.0. Alaska Department of Fish and Game Juneau, Alaska.

Ebbesmeyer, C.C., D.R. Cayan, D.R. McLaine, F.H. Nichols, D.H. Peterson, and K.T. Redmong. 1991. 1976 Step in the Pacific Climate: Forty Environmental Changes Between 1968-1975 and 1977-1984. Pages 115-126 *in:* Proceedings of the Seventh Annual Pacific Climate (PACLIM) Workshop, Asilomar, California, 1990. Technical report 26. California Department of Water Resources, Sacramento, California.

Eberhardt, L.E., W.C. Hanson, J.L. Bengtson, R.A. Garrott, and E.E. Hanson. 1982. Arctic Fox Home Range Characteristics in an Oil-development Area. *Journal of Wildlife Management,* 46:183–190.

Eberhardt, W.L. 1977. The Biology of Arctic and Red Foxes on the North Slope. M.S. thesis, University of Alaska, Fairbanks.

ECA. 1999a. Future (2000-2034) Demand for Tankers to Serve ANS Trade: A Working Paper. Everest Consulting Associates, Cranbury, New Jersey.

ECA. 1999b. Federal Revenues. Memo to S. Goldsmith, UAA, C. Loggie, Exxon, BP Exploration (Alaska), Inc., and to the file. Everest Consulting Associates, Cranbury, New Jersey.

Ecology and Environment, Inc. 1977. Environmental Surveillance During Construction of the Trans-Alaska Pipeline System. Prepared for Mechanics Research, Inc. under Alaska Pipeline Office COR 5315.

Education Systems Resources Corporation. 1971. A Study of the Impact of the Proposed Trans-Alaska Pipeline on the Alaska Native Population. Prepared for Bureau of Indian Affairs, Arlington, Virginia.

EIA. (Various years). Petroleum Supply Annual, Volume 1. Energy Information Administration, Washington, D.C.

EIA. 1998. Annual Energy Outlook. Energy Information Administration, Washington, D.C.

EIA. 1999a. International Petroleum Statistics Report, June. Energy Information Administration, Washington, D.C.

EIA. 1999b. Crude Oil Supply and Disposition 1973 - Present. Energy Information Administration, Washington, D.C. From web site: www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_monthly/current/txt/table_s02_a.txt.

EIA. 1999c. Value of Crude Oil Imports from Selected Countries, 1973-1998. Energy Information Administration, Petroleum Overview, Washington, D.C. From web site: www.eia.doe.gov.

EIA. 1999d. Petroleum Overview: Field Production - Crude Oil Supply and Disposition: Disposition and Ending Stocks. Petroleum Monthly Energy Review Energy Information Administration, Washington, D.C.

EIA. 1999e. Annual Energy Outlook 2000 with projections to 2020. Energy Information Administration, Washington, D.C.

Eide, S.H., S.D. Miller, and M.A. Chihuly. 1986. Oil Pipeline Crossing Sites Utilized in Winter by Moose, *Alces alces*, and Caribou, *Rangifer tarandus*, in Southcentral Alaska. *Canadian Field-Naturalist*, 100:197-207.

Elanna, L.J., and G.K. Sherrod. 1984. The Role of Kinship Links in Subsistence Production: Some Implications for Community Organization. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Elliott, G.V. 1982. Evaluation of Stream Crossings and Effects of Channel Modifications on Fishery Resources Along the Route of the Trans-Alaska Pipeline, Final Report. U.S. Fish and Wildlife Service, Special Studies, Anchorage, Alaska.

Ellis, D.H., C.H. Ellis, and D.P. Mindell. 1991. Raptor Responses to Low-level Jet Aircraft and Sonic Booms. *Environmental Pollution* 74:53-83.

Elton, C. 1942. Voles, Mice, and Lemmings: Problems in Population Dynamics. Clarendon Press, Oxford, England.

Emers, M., and J.C. Jorgenson. 1997. Effects of Winter Seismic Exploration on Tundra Vegetation and the Soil Thermal Regime on the Arctic National Wildlife Refuge, Alaska. Pages 443-456 *in:* R.M.M. Crawford (ed.). Disturbance and Recovery in Arctic Lands, An Ecological Perspective. Kluwer Academic Publishers, Dordrecht, Netherlands.

Emers, M., J.C. Jorgenson, and M.K. Raynolds. 1995. Response of Arctic Tundra Plant Communities to Winter Vehicle Disturbance. *Canadian Journal Botany,* 73:905-917.

Envirosphere. 1987. Endicott Environmental Monitoring Program, Final Report, 1985. Envirosphere Company. Prepared for U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

EPA. 1993a. Authorization to Discharge Under the National Pollutant Discharge Elimination System, Permit No. Alaska-005056-3, issued to Alyeska Pipeline Service Company for Pipeline Maintenance and Operation, effective July 30, 1993. U.S. Environmental Protection Agency.

EPA. 1997. Authorization to Discharge Under the National Pollutant Discharge Elimination System, Permit No. Alaska-002324-8, issued to Alyeska Pipeline Service Company for Valdez Marine Terminal, effective May 21, 1997. U.S. Environmental Protection Agency.

EPA. 1999a. Consideration of Cumulative Impacts in EPA Review of NEPA Documents. U.S. Environmental Protection Agency. Office of Federal Activities. From web site: http://es.epa.gov/oeca/ofa/cumula.html.

Epler, P. 1989a. Divers Find Crack in Hull of Tanker Leaking Crude Oil. Page A1 *in:* Anchorage Daily News, January 5, 1989. Anchorage, Alaska.

Epler, P. 1989b. Alyeska to Spend $300,000 for Oil Cleanup. Page C2 *in:* Anchorage Daily News, January 6, 1989. Anchorage, Alaska.

Epler, P. 1990. Alaska Firms Help Clean Up California Spill. Page C1 *in:* Anchorage Daily News, February 16, 1990. Anchorage, Alaska.

Eppenbach, L. 1993. Distribution of Income from Alaska Oil and Gas Operations and the Role of State Tax Policy. Legislative Research Agency Report 93.001. Alaska State Legislature, Juneau, Alaska.

Esch, D.C., and T.E. Osterkamp, 1991. Cold Region Engineering: Climate Warming Concerns for Alaska. *Journal of Cold Region Engineering,* 4(1):6-14.

Espmark, Y. 1968. Observations of Defense Reactions to Oestrid Flies by Semi-domesticated Forest Reindeer *Rangifer tarandus* L. in Swedish Lapland. *Zool. Beiträge,* 14:155-167.

Estes, J.A. 1991. Catastrophes and Conservation: Lessons from Sea Otters and the *Exxon Valdez*. *Science,* 254:1596.

Etkin, D.S. 1998. Financial Costs of Oil Spills in the U.S. Cutter Information Corporation, Arlington, Massachusetts.

Everett, K.R. 1978. Some Effects of Oil on the Physical and Chemical Characteristics of Wet Tundra Soils. *Arctic,* 31:260–276.

Everett, K.R. 1980. Distribution and Properties of Road Dust Along the Northern Portion of the Haul Road. Chapter 3 *in:* J. Brown and R. L. Berg, (eds.). Environmental Engineering and Ecological Investigations Along the Yukon River-Prudhoe Bay Haul Road. CRREL Report 80-19. U.S. Army Cold Regions Research Engineering Laboratory, Hanover, New Hampshire.

Everett, R.J., and R.L. Wilmot. 1987. Population Genetic Structure of Arctic Char (*Salvelinus alpinus*) from Rivers of the North Slope of Alaska. OCSEAP Final Report 63:63-121. Department of Commerce, National Oceanographic and Atmospheric Administration.

Executive Order 12898. 1994. William Jefferson Clinton, President of the United States. February 11, 1994.

Executive Order 13007. 1996. William Jefferson Clinton, President of the United States. May 24, 1996.

Exxon Corporation. 1999. Web site accessed 10/20/99. From web site: www.exxon.com/exxoncorp/newsand publications/valdez_bulletin/99046.html.

Exxon Valdez Oil Spill Trustee Council. 1994. Final Environmental Impact Statement for the Exxon Valdez Oil Spill Restoration Plan. Anchorage, Alaska.

Exxon Valdez Oil Spill Trustee Council. 2000. *Exxon Valdez*

Oil Spill Trustee Council 2000 Status Report. Anchorage, Alaska.

ExxonMobil. 2000. ANS Gas Commercialization: The Gas-to-Liquids Alternative. Prudhoe Bay GTL Conversion Project. ExxonMobil Production Company.

FAA. 1997. FAA Statistical Handbook of Aviation. Federal Aviation Administration. From web site: http://.api.hq.faa.gov/handbook96/toc96.htm.

Faanes, C.A., and S.E. Senner. 1991. Status and Conservation of the Eskimo Curlew. *American Birds,* 45:237–239.

Fairbanks North Star Borough. 1978. Community Information Quarterly, Volume I, No. 1. Community Information Center, Fairbanks, Alaska.

Fall, J.A. 1995. Subsistence Restoration Planning and Implementation. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska.

Fall, J.A., and C.J. Utermohle (eds.). 1995. An Investigation of the Sociocultural Consequences of Outer Continental Shelf Development in Alaska. 6 Vols. Minerals Management Service, Anchorage, Alaska.

Fall, J.A., and C.J. Utermohle (compilers). 1999. Subsistence Service Update: Subsistence Harvest and Uses in Eight Communities Ten Years after the Exxon Valdez Oil Spill. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska.

Fall, J.A., L. Stratton, P. Coiley, L. Broen, C.J. Utermohle, and G. Jennings. 1996. Subsistence Harvests and Uses in Chenega Bay and Tatitlek in the Year Following the *Exxon Valdez* Oil Spill. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Fancy, S.G. 1982. Reaction of Bison to Aerial Surveys in Interior Alaska*. Canadian Field-Naturalist,* 96:91.

Fancy, S.G. 1986. Daily Energy Budgets of Caribou: A Simulation Approach. Ph.D. thesis, University of Alaska, Fairbanks.

Fancy, S.G., K.R. Whitten, N.E. Walsh, and R.D. Cameron. 1992. Potential Impacts of Petroleum Exploration and Development on the Numbers, Distribution and Status of Caribou on the Arctic Coastal Plain, Work Subunit 1A. Population Dynamics and Demographics of Caribou in Developed and Undeveloped Areas of the Arctic Coastal Plain. Pages 1-20 *in:* T.R. McCabe, B. Griffith, N.E. Wash, and D.D. Young (eds.). Terrestrial Research: 1002 Area – Arctic National Wildlife Refuge, Interim Report, 1988-1990. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Farmer, C.J., M.D. Kirchhoff, and D.K. Person. 1998. Effects of Even-aged Timber Management on Survivorship in Sitka Black-tailed Deer, Southeast Alaska. Federal Aid in Wildlife Restoration Research Progress Report, Project W-27-1, Study 14.16. Alaska Department of Fish and Game, Juneau, Alaska.

Fay, F.H., and J.J. Burns. 1988. Maximal Feeding Depth of Walruses. *Arctic* 41(3):239-240.

Fechhelm, R.G. 1999. The Effect of New Breaching in a Prudhoe Bay Causeway on the Coastal Distribution of Humpback Whitefish. *Arctic,* 52(4):386-394.

Fechhelm, R.G., and D.B. Fissel. 1988. Wind-aided Recruitment of Canadian Arctic Cisco (*Coregonus autumnalis*) into Alaskan waters. *Canadian Journal of Fisheries and Aquatic Science,* 45:906-910.

Fechhelm, R.G., and W.B. Griffiths. 1990. The Effect of Wind on the Recruitment of Canadian Arctic Cisco (*Coregonus autumnalis*) into the Central Alaskan Beaufort Seas. *Canadian Journal of Fisheries and Aquatic Sciences,* 47(11):2164-2171.

Fechhelm, R.G., J.S. Baker, W.B. Griffiths, and D.R. Schmidt. 1989. Localized Movement Patterns of Least Cisco (*Coregonus sardinella*) and Arctic Cisco (*C.autumnalis*) in the Vicinity of a Solid-fill Causeway. Biological Paper, University of Alaska, 24:75-106.

Fechhelm, R.G., J.D. Bryan, W.B. Griffiths, B.J. Gallaway, and W.J. Wilson. 1994. The Effects of Coastal Winds on the Summer Dispersal of Young Least Cisco (*Coregonus sardinella*) from the Colville River to Prudhoe Bay, Alaska: A Simulation Model. *Canadian Journal of Fisheries and Aquatic Science,* 51:890-899.

Fechhelm, R.G., R.E. Dillinger, and B.J. Gallaway. 1992. Modeling of In Situ Temperature and Growth Relationships for Yearling Broad whitefish in Prudhoe Bay, Alaska. Transactions of the American Fisheries Society, 121:1-12.

Fechhelm, R.G., W.B. Griffiths, L.R. Martin, and B.J. Gallaway. 1996. Intra- and Inter-seasonal Variation in the Relative Condition and Proximate Body Composition of Arctic Ciscoes from the Prudhoe Bay Region of Alaska. Transactions of the American Fisheries Society, 125:600-612.

Fechhelm, R.G., L.R. Martin, B.J. Gallaway, W.J. Wilson, and W.B. Griffiths. 1999. Prudhoe Bay Causeways and the Summer Coastal Movements of Arctic Cisco and Least Cisco. *Arctic,* 52(2):139-151.

Feder, H.M., and S.C. Jewett. 1988. The Subtidal Benthos. Pages 165-202 *in:* D. G. Shaw and M. J. Hameedi (eds.). Environmental Studies in Port Valdez, Alaska. A Basis of Management. Springer-Verlag, New York, New York.

Feder, H.M., and D.G. Shaw. 2000. Environmental Studies in Port Valdez, Alaska: 1999. Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks. 195 pp.

Felix, N.A., and M.K. Raynolds. 1989. The Effects of Winter Seismic Trails on Tundra Vegetation in Northeastern Alaska, USA. *Arctic and Alpine Research,* 21:188-202.

FERC. 1993. Yukon Pacific LNG Project. Draft Environmental Impact Statement (DEIS). Federal Energy Regulatory Commission, Office of Pipeline Regulation, Washington, D.C. Docket Nos. CP88–105–000 and CP88–105–001.

FERC. 1995. Yukon Pacific LNG Project. Final Environmental Impact Statement. Federal Energy Regulatory Commission, Office of Pipeline Regulation, Washington, D.C.

Ferguson, D. 1995. New Perspectives on the Proposed Late Pleistocene Occupation of the Gallagher Flint Station (PSM-050), North Slope, Alaska. Report to the Geist Fund Committee, University of Alaska Museum, Fairbanks, Alaska.

Ferguson, D.E. 1997. Revised Temporal Assessment of a Proposed Paleoarctic Site in the Sagavanirktok Valley, Northern Alaska. *Current Research in the Pleistocene,* 15:24–26.

Ferrians, O.J. Jr., R. Kachadoorian, and G.W. Greene. 1969. Permafrost and Related Engineering Problems in Alaska. U.S. Geological Survey, Professional Paper 678.

Ferrians, O.J. Jr., D.R. Nichols, and J.R. Williams. 1989. Copper River Basin. Pages 39-43 *in:* T. L. Pewe, and Richard D. Reger (eds.). Glacial Geology and Geomorphology of North America: 28th International Geological Congress. Vol. 1. American Geophysical Union, Washington, D.C.

FFC. 1967. Villages in Alaska and Other Places Having a Native Population of 25 or More (Estimates 1967). Federal Field Committee, Anchorage, Alaska.

FFC. 1968. Alaska Natives and the Land. Federal Field Committee, Anchorage, Alaska.

FFC. 1969. Estimates of Native Population in Villages, Towns, and Boroughs of Alaska. Federal Field Committee, Anchorage, Alaska.

FFC. 1971a. Community Inventory, Alaska 1971. Federal Field Committee, Anchorage, Alaska.

FFC. 1971b. Economic Outlook for Alaska. Federal Field Committee, Anchorage, Alaska.

FHWA. 1996. 1996 Highway Statistics. Federal Highway Administration, Office of Highway Information Management. From web site: www.fhwa.dot.gov/ohim/1996/index.htm.

Fineberg, R.A. 1997. Pipeline in Peril, Alaska at Risk on the 20th Anniversary of the Trans-Alaska Pipeline, an Update of Events on the Troubled Alaska Pipeline Since September 1996. Prepared for Alaska Forum for Environmental Responsibility, Ester, Alaska.

Fischer, J.B. and A.G. Palmer. 1993. Survey and Removal of Introduced Arctic Fox at Little Tanaga, Umak, and Igitkin Islands. June - Sept 1992. U.S. Fish and Wildife Service Report AMNWR 93/04. Adak, Alaska.

Fitzhugh, W., and A. Crowell (eds.) 1988. Crossroads of Continents: Cultures of Alaska and Siberia. Smithsonian Institution Press, Washington, D.C.

Flanders, W. 2000. Alyeska Pipeline Service Company, personal communication, November 20, 2000.

Flint, P.L., and M.P. Herzog. 1999. Breeding of Steller's Eiders, *Polysticta stelleri*, on the Yukon-Kuskokwim Delta, Alaska. *Canadian Field-Naturalist,* 113:306-308.

Fluor. 1983. Trans-Alaska Pipeline System Dismantling, Removal, and Restoration, Cost Estimate Report. Fluor Engineering. Docket Numbers OR78-1 and P-81-1. April 1983.

Fluor and TRC. 1995. Application for Prevention of Significant Deterioration Approval and Air Quality Control Permit to Operate, Valdez Marine Terminal Vapor Control Project. Fluor Daniel Inc. and TRC Environmental Corporation. Submitted to Alaska Department of Environmental Conservation. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska. July 1995.

Follmann, E.H. 1989. The Importance of Advance Planning to Minimize Bear-people Conflicts During Large Scale Industrial and Transportation Developments in the North. Pages 105-110 *in:* Bear-People Conflicts: Proceedings of a Symposium on Management Strategies. Department of Renewable Resources, Northwest Territories, Canada.

Follmann, E.H., and J.L. Hechtel. 1990. Bears and Pipeline Construction in Alaska. *Arctic,* 43:103-109.

Follmann, E.H., R.A. Dieterich, and J. Hechtel. 1980. Recommended Carnivore Control Program for the Northwest Alaskan Pipeline Project, Including a Review of Human-carnivore Encounter Problems and Animal Deterrent Methodology, Final Report. Prepared by Institute of Arctic Biology, University of Alaska, Fairbanks. Prepared for NW Alaska Pipeline Company.

Follmann, E.H., D.G. Ritter, and G.M. Baer. 1988. Immunization of Arctic Foxes with Oral Rabies Vaccine. *Journal Wildlife Disease,* 24:477-483.

Foote, D.C. 1959. The Economic Base and Seasonal Activities of Some Northwest Alaskan Villages: A Preliminary Study. Submitted to the U.S. Atomic Energy Commission.

Foote, D.C. 1960a. The Eskimo Hunter at Point Hope, Alaska, Part I, September 1959 to May 1960. Prepared for Bio-Environmental Studies of Project Chariot, U.S. Atomic Energy Commission.

Foote, D.C. 1960b. The Eskimo Hunter at Point Hope, Alaska, Part II, May to September 1960. Prepared for Bio-Environmental Studies of Project Chariot, U.S. Atomic Energy Commission.

Foote, D.C. 1961. A Human Geographical Study in Northwest Alaska. Final Report of the Human Geographic Studies Program. Project Chariot, U.S. Atomic Energy Commission, Cambridge.

Forbes, B.C., and R.L. Jefferies. 1999. Revegetation of Disturbed Arctic Sites: Constraints and Applications. *Biological Conservation,* 88:15-24.

Ford, J.A. 1959. Eskimo Prehistory in the Vicinity of Point Barrow, Alaska. Anthropological Papers of the American Museum of Natural History, 47(1).

Ford, J.K.B. 1989. Acoustic Behaviour of Resident Killer Whales (*Orcinus orca*) of Vancouver Island, British Columbia. *Canadian Journal of Zoology,* 67:727–745.

Ford, J.K.B., G.M. Ellis, and K.C. Balcomb. 1994. Killer Whales: The Natural History and Genealogy of *Orcinus* *orca* in British Columbia and Washington State. University of British Columbia Press, Vancouver, B.C., Canada.

Forman, R.T., and L.E. Alexander. 1998. Roads and Their Major Ecological Effects. *Annual Review of Ecological Systematics,* 29:207-231.

Foster, D. 1987. Unchartered Rock Found in the Inlet Officials Map Obstacle Near Site of Tanker Leak. Page B1 *in:* Anchorage Daily News, July 29, 1987. From web site: www.adnsearch.com.

Foster, K., L. Leask, and T. Hull. 1988. The Effects of Alaska's Economic Recession on Anchorage Households. Alaska Review of Social and Economic Conditions, Vol. XXV, No. 2, May 1988.

Fox, J.L., C.A. Smith, and J.W. Schoen. 1989. Relation Between Mountain Goats and Their Habitat in Southeastern Alaska. General Technical Report PNW-GTR-246. U.S. Forest Service, Pacific Northwest Research Station, Portland, Oregon.

FPC. 1976. Alaska Natural Gas Transportation Systems. Volume 1. El Paso Alaska Company. Docket No. CP 75–96, et al. U.S. Department of Commerce, Federal Power Commission Staff, Washington, D.C. PB 272 748.

Frost, K.J., and L.F. Lowry. 1988. Effects of Industrial Activities on Ringed Seals in Alaska, as Indicated by Aerial Surveys. Pages 15-25 *in:* W.M. Sackinger et al., (eds.). Port and Ocean Engineering Under Arctic Conditions. Volume II. Symposium on Noise and Marine Mammals. Geophysical Institute, University of Alaska, Fairbanks, Alaska.

Frost, K.J., and L.F. Lowry. 1999. Monitoring Distribution and Abundance of Ringed Seals in Northern Alaska. Interim Report to U.S. Department of the Interior, Minerals Management Service, Anchorage, Alaska.

Frost, K.J., L.F. Lowry, and G. Carroll. 1993. Beluga Whale and Spotted Seal Use of a Coastal Lagoon System in the Northeastern Chukchi Sea. *Arctic* 46(1)8-16.

Frost, K.J., L.F. Lowry, J.R. Gilbert, and J.J. Burns. 1989. Ringed Seal Monitoring: Relationships of Distribution and Abundance to Habitat Attributes and Industrial Activities. OSCEAP Final Report 61:345-445. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration.

Frost, K.J., L.F. Lowry, E.H. Sinclair, J. Ver Hoef, and D.C. McAllister. 1994. Impacts on the Distribution, Abundance, and Productivity of Harbor Seals. Pages 97-118 *in:* T.R. Loughlin, (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Frost, K.J., L.F. Lowry, J.M. VerHoef, and S.J. Iverson. 1999. Monitoring the Trend of Harbor Seals in Prince William Sound, Alaska, After the *Exxon Valdez* Oil Spill. *Marine Mammal Science,* 15:494-506.

Frost, K.J., C.A. Manen, and T.L. Wade. 1994. Petroleum Hydrocarbons in Tissues of Harbor Seals from Prince William Sound and the Gulf of Alaska. Pages 331-358 *in:* T.R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Fruge, D.J., D.W. Wiswar, L.J. Dugan, and D.E. Palmer. 1989. Fish Population Characteristics of Arctic National Wildlife Refuge Coastal Waters, Summer 1988. U.S. Fish and Wildlife Service, Fairbanks, Alaska.

FSB. 1999. Federal Subsistence Board web site: www.r7.fws.gov/asm/fsbbook/index.html.

FSB. 2000. Subsistence Management Regulations for the Harvest of Wildlife on Federal Public Lands in Alaska. July 1, 2000-June 30, 2001. Federal Subsistence Board, U.S. Fish and Wildlife Service, Office of Subsistence Management, Anchorage, Alaska.

Funk, D.W., and E.K. Bonde, 1986. Effects of Artificial Acid Mist on Growth and Reproduction of Two Alpine Plant Species in the Field. *American Journal of Botany,* 73:524-528.

Funk, D.W., K.M. Peterson, and W.D. Billings. 1991. Plant Mineral Nutrition and Soil Nutrient Availability During Succession in Arctic Alaska. Proceedings of the Ecological Society of America 72:120.

Furniss, R.A. 1975. Prudhoe Bay Study. Inventory and Cataloging of Arctic Area Waters. Pages 31-47 *in*: Federal Aid in Fish Restoration, 1974-1975, Vol. 16, Study G-I-1. Alaska Department of Fish and Game, Sport Fishing Division, Juneau, Alaska.

FWS. 1970. A Reconnaissance Report on the Impact on Fish and Wildlife Resources of the North Slope Oil Development, the Trans-Alaska Pipeline System and the Marine Terminal Sites. U.S. Fish and Wildlife Service, Juneau, Alaska.

FWS. 1995b. Habitat Conservation Strategy for Polar Bears in Alaska. U.S. Fish and Wildlife Service, Anchorage, Alaska.

FWS. 1996a. Endangered, Threatened, and Candidate Species in Alaska. Unpublished report prepared by U.S. Fish and Wildlife Service, Office of Ecological Services, Anchorage, Alaska.

FWS. 1996b. Spectacled Eider Recovery Plan. U.S. Fish and Wildlife Service, Anchorage, Alaska.

FWS. 1998a. Steller's Eider Recovery Plan — Draft. U.S. Fish and Wildlife Service, Anchorage, Alaska.

FWS. 1998b. Endangered and Threatened Species: Proposal to List the Coastal-Puget Sound, Jarbridge River and St. Mary-Belly River Population Segments of Bull Trout as Threatened Species. Federal Register: June 10, 1998, Volume 63, Number 111:31693-31710. U.S. Fish and Wildlife Service.

FWS. 1999a. Endangered, threatened, and candidate species in Alaska. Unpublished report prepared by U.S. Fish and Wildlife Service, Office of Ecological Services, Anchorage, Alaska.

FWS. 1999b. Alaska Seabird Colony Catalog, Kenai Peninsula. U.S. Fish and Wildlife Service, Anchorage, Alaska.

FWS. 1999c. Alaska Seabird Colony Catalog, Prince William Sound. U.S. Fish and Wildlife Service, Anchorage, Alaska.

FWS. 1999d. Alaska Seabird Colony Catalog, Copper River Delta. U.S. Fish and Wildlife Service, Anchorage, Alaska.

FWS. 1999e. Final Rule to Remove the American Peregrine Falcon from the Federal List of Endangered and Threatened Wildlife. Federal Register 64(164):46542-46558.

Gabriel, H.W., and G.F. Tande. 1983. A Regional Approach to Fire History in Alaska. Report BLM/Alaska/TR-83/09. Bureau of Land Management, Anchorage, Alaska.

Gabrielson, I.N., and F.C. Lincoln. 1959. The Birds of Alaska. The Stackpole Company, Harrisburg, Pennsylvania, and the Wildlife Management Institute, Washington, D.C.

Gal, R. 1976. Paleo-Indians of the Brooks Range: A Tradition of Uncontrolled Comparison. Paper presented at the Society for American Archaeology Annual Meeting, St. Louis, Missouri.

Galginaitis, M., C. Chang, K.M. MacQueen, A.A. Dekin, Jr., and D. Zipkin. 1984. Ethnographic Study and Monitoring Methodology of Contemporary Economic Growth, Socio-Cultural Change and Community Development in Nuiqsut, Alaska. Alaska OCS Social and Economics Studies Unit. Technical Report No. 96. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

Gallant, A.L., E.F. Binnian, J.M. Omernik, and M.B. Shasby. 1995. Ecoregions of Alaska. U.S. Geological Survey Professional Paper 1567, Washington, D.C.

Gallaway, B.J., and R.G. Fechhelm. 2000. Anadromous and Amphidromous Fishes. Pages 349-369 *in:* J.C.Truett and S. R. Johnson (eds.). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Gallaway, B.J., W.J. Gazey, J.M. Colonell, A.W. Neidoroda, and C.J. Herlugson. 1991. The Endicott Development Project—Preliminary Assessment of Impacts from the First Major Offshore Oil Development in the Alaskan Arctic. American Fisheries Society Symposium 11:42-80. American Fisheries Society, Bethesda, Maryland.

Gallaway, B.J., W.J. Gazey, and L.L. Moulton. 1989. Population Trends for the Arctic Cisco (*Coregonus autumnalis*) in the Colville River of Alaska as Reflected by the Commercial Fishery. Biological Papers, University of Alaska, 24:153-165.

Gallaway, B.J., W.B. Griffiths, P.C. Craig, W.J. Gazey, and J.W. Helmericks. 1983. An Assessment of the Colville River Delta Stock of Arctic Cisco—Migrants from Canada? Biological Paper, University of Alaska, 21:4-23.

GAO. 1978. Lessons Learned from Constructing the Trans-Alaska Oil Pipeline, PB283 117. U.S. General Accounting Office.

GAO. 1981. Trans-Alaska Oil Pipeline Operations: More Federal Monitoring Needed. EMD-81-11. U.S. General Accounting Office, Gaithersburg, Massachusetts.

GAO. 1999. Alaskan North Slope Oil: Limited Effects of Lifting Export Ban on Oil and Shipping Industries and Consumers. GAO/RCED–99–191. See also: GAO. 1990. Energy Security: Impacts of Lifting Alaskan North Slope Oil Exports Ban. GAO/RCED–91–21. U.S. General Accounting Office, Washington, D.C.

Garant, Y., and G.J. Doucet. 1993. An Experimental Winter Cut in a Powerline ROW Located in a White-tailed Deer Yard. Pages 266-268 *in:* G.J. Doucet, C. Seguin, and M. Giguere (eds.). Proceedings of the Fifth International Symposium on Environmental Concerns in Rights-of-Way Management, 19-22 September 1993.

Garner, G.W., and P.E. Reynolds. 1986. Gray wolf. Pages 316-337 *in*: Baseline Study of the Fish, Wildlife and Their Habitats – Final Report. Vol. 1. Arctic National Wildlife Refuge Coastal Plain Resource Assessment. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Garshelis, D.L. 1983. Ecology of Sea Otters in Prince William Sound, Alaska. Ph.D. dissertation, University of Minnesota, Minneapolis.

Garshelis, D.L., and C.B. Johnson. In press. Population Dynamics of Sea Otters and the *Exxon Valdez* Oil Spill: Sorting Out the Confounding Effects. *Journal of Applied Ecology*.

Gasaway, W.C., and S.D. DuBois. 1985. Initial Response of Moose, *Alces alces*, to a Wildfire in Interior Alaska. *Canadian Field-Naturalist,* 99:135-140.

Gasaway, W.C., S.D. DuBois, R.D. Boertje, D.J. Reed, and D.T. Simpson. 1989. Response of Radio-collared Moose to a Large Burn in Central Alaska. *Canadian Journal of Zoology,* 67:425-329.

Gasaway, W.C., R.O. Stephenson, J.L. Davis, P.E.K. Shepard, and O.E. Burris. 1983. Interrelationships of Wolves, Prey, and Man in Interior Alaska. Wildlife Monograph No. 84.

George, J.C. 1999. North Slope Borough, Department of Wildlife Management, personal communication.

Gerhart, K.L. 1995. Nutritional and Ecological Determinants of Growth and Reproduction in Caribou. A thesis for Ph.D. presented to the faculty of the University of Alaska, Fairbanks.

Gerlach, S.C. (compiler). 1990. Summary of Cultural Resource Investigations for Alyeska Pipeline Service Company. Occasional Papers in Anthropology 1(2). Alaska Quaternary Center.

Gerlach, S.C., and E.S. Hall. 1988. Later Prehistory of North Alaska: The View from Tukuto Lake. Pages 107–135 *in:* R.D. Shaw, R.K. Harritt, and D.E. Dumond (eds.). Late Prehistoric Development of Alaska's Native People. Aurora: Alaska Anthropological Association Monograph Series.

Gerlach, S.C., S.J. McGowan, S.J. McIntosh, T.A. O'Brien, and J.C. Pierce. 2000. Trans-Alaska Pipeline System Corridor Community Profiles, Vol. I. Prepared for ClearWater Environmental, Inc., Anchorage, Alaska.

Giblin, A.E., K.J. Nadelhoffer, G.R. Shaver, J.A. Laundre, and

A.J. Mckerrow. 1991. Biogeochemical Diversity Along a Riverside Toposequence in Arctic Alaska. *Ecological Monographs*, 61:415-435.

Gibson, D.D. 1999. Checklist of Alaska Birds. Ninth Edition. University of Alaska Museum, Fairbanks, Alaska.

Gibson, D.D., and B. Kessel. 1989. Geographic Variation in the Marbled Godwit and Description of an Alaskan Subspecies. *Condor* 91:436-443.

Gilbert, J., G. Fedorov, D. Seagars, E. Razlivalov, and A. Lachugin. 1992. Aerial Census of Pacific Walrus, 1990. U.S. Fish and Wildlife Service Administrative Report R7/ MMM 92-1.

Gilders, M.A. 1997. Crossing Alaska. Graphic Arts Center Publishing Company, Portland, Oregon.

Gilders, M.A., and M.A. Cronin. 2000. North Slope Oil Field Development. Pages 15-33 *in:* The Natural History of an Arctic Oil Field; Development and the Biota. Academic Press, San Diego, California.

Gill, R.E., Jr., P. Canevari, and E.H. Iversen. 1998. Eskimo Curlew (*Numenius borealis*). *in*: A. Poole and F. Gill (eds.). The Birds of North America, No. 347. The Birds of North America, Inc., Philadelphia, Pennsylvania.

Gladziszewski, M. 1996. State of Alaska Natural Resource Revenues and Expenditures in FY 95. Research Request 96.055. Alaska State Legislature, Legislative Affairs Agency, Division of Legal and Research Services, Juneau, Alaska.

Glass, D., C. Whitmus, and M. Prewitt. 1990. Fish Distribution and Abundance. Vol. 5, Chapter 1, Part IV *in:* Endicott Environmental Monitoring Program Final Reports, 1986. Unpublished report by Envirosphere Company. Available at U.S. Army Corps of Engineers, Anchorage, Alaska.

Globig, J. 1999. Alyeska Pipeline Service Company, Maintenance Department, personal communication, November 2, 1999.

Glova, G., and P. McCart. 1974. Life History of Arctic Char (*Salvelinus alpinus*) in the Firth River, Yukon Territory. Arctic Gas Biological Report Series 40.

Golden, H.N. 1989. Game Management Unit 13 Central Arctic Herd. Pages 166-173 *in* S. O. Morgan (ed.). Annual Report of Survey-Inventory Activities. Part XI. Caribou. Federal Aid in Wildlife Restoration Progress Report, Vol. XIX. Project W-23-1, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Goldsmith, O.S. 1985. The Importance of Petroleum in the Alaska Economy. ISER Working Paper 85:1. Institute of Social and Economic Research.

Goldsmith, O.S. 1990. Tracing the Growth of Alaska State Spending Since 1979. Presented at the Western Economic Association Annual Meeting, San Diego, California.

Goldsmith, O.S. 1991. The Economic Cost of a Rent-Induced Business Cycle: The Alaska Petrodollar Boom. ISER Fiscal Policy Working Paper, February 3, 1991. Institute of Social and Economic Research.

Goldsmith, O.S. 1995. Marginal Oil Field Development: the Economic Impact. Prepared for BP Exploration (Alaska) Inc.

Goldsmith, O.S. 1995a. The Economic Contribution of the Anchorage International Airport. Prepared for Anchorage International Airport.

Goldsmith, O.S. 1997. Structural Analysis of the Alaska Economy: A Perspective From 1997. Prepared for Alaska Science and Technology Foundation.

Goldsmith, O.S. 1998. Anchorage International Airport 1998: Economic Significance. Prepared for Anchorage International Airport.

Goldsmith, O.S. 1999a. Alaska's Gross State Product. Prepared for Alaska Department of Commerce and Economic Development.

Goldsmith, O.S. 1999b. Economic Projections for Alaska and the Southern Railbelt: 1999–2025. Institute of Social and Economic Research. Prepared for Chugach Electric Association.

Goldsmith, O.S. 2000a. In press. Fiscal Policy Paper, 13. A Citizen's Guide to the Alaska Budget. Institute of Social and Economic Research.

Goldsmith, O.S. 2000b. ISER Database Working Paper. 001:1. Institute of Social and Economic Research.

Goldsmith, O.S., and A. Hill. 1997. Alaska's Economy and Population: 1959–2020. Institute of Social and Economic Research. Prepared for Alaska Department of Transportation and Public Facilities.

Goldsmith, O.S., and L. Huskey. 1978. Structural Change in the Alaska Economy: the Alyeska Experience. Presented at Twenty-nineth Alaska Science Conference.

Goldsmith, O.S., M. Berman, L. Huskey, L. Leask, and T. Hull. 1988. Alaska Housing and the Recession. Alaska Review of Social and Economic Conditions, Vol. 5, 2.

Goldsmith, O.S., J. Kruse, and M. Scott. 1976. A Preliminary Overview of the Economic and Social Effects of the Proposed Northwest Gas Pipeline on Alaska. Institute of Social and Economic Research. Prepared for Gulf Interstate, Inc.

Gollop, J.B., T.W. Barry, and E.H. Iversen. 1986. Eskimo Curlew: A Vanishing Species? Saskatchewan Natural History Society Special Publication. 17.

Gollop, M.A., and R.A. Davis. 1974a. Effects of Gas Compressor Noise Simulator Disturbance to Terrestrial Breeding Birds, Babbage River, Yukon Territory, June, 1972. Arctic Gas Biological Report Series No. 14: Chapter 2.

Gollop, M.A., and R.A. Davis. 1974b. Gas Compressor Noise Simulator Disturbance to Snow Geese, Komakuk Beach, Yukon Territory, September, 1972. Arctic Gas Biological Report Series No. 14: Chapter 8.

Gosink, T.A. 1980. Chapter 5: Trace Element Baselines Pages 11-35 *in:* J.M. Colonell (ed.). Port Valdez, Alaska: Envi-

ronmental Studies 1976-1979. Institute of Marine Science, University of Alaska, Fairbanks.

Gould, P.J., D.J. Forsell, and C.J. Lensink. 1982. Pelagic Distribution and Abundunce of Seabirds in the Gulf of Alaska and Eastern Bering Sea. U.S. Fish and Wildlife Service, Biological Services Program, Anchorage, Alaska. Report No. FWS/OBS-82/48.

Graef, K.V. 1999. The Milepost. Morris Communications Corporation.

Griese, H.J. 1989a. Unit 6 Deer Survey-inventory Progress Report. Pages 40-77 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Part VI. Deer. Volume XIX. Federal Aid in Wildlife Restoration Progress Report Project W-23-1, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griese, H.J. 1989b. Game Management Unit 6 Prince William Sound and North Gulf Coast. Pages 22-29 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities, 1 January 1987 – 31 December 1987. Brown/Grizzly Bear. Vol. XIX, Part V. Federal Aid in Wildlife Restoration Report, Project W-23-1, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griese, H.J. 1989c. Game Management Unit 6. Pages 32-37 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Part IV. Black Bears. Federal Aid in Wildlife Restoration Progress Report, Vol. XIX, Projects W-23-1, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griese, H.J. 1989d. Game Management Unit 6 Wolf Survey-inventory Report. Pages 21-27 *in:* S.O. Morgan (ed.). Volume XIX, Wolf. Federal Aid in Wildlife Restoration Project W-23-1, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griese, H.J. 1990. Game Management Unit 6. Pages 54-70 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Mountain Goat. Part VII. Volume XX. Federal Aid in Wildlife Restoration Progress Report, Project W-23-2, Job 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griese, H.J. 1991a. Unit 6 Deer Survey-inventory Progress Report. Pages 41-56 *in:* S.M. Abbott (ed.). Annual Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Progress Report, Project W-23-4, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griese, H.J. 1991b. Game Management Unit 6 Prince William Sound and North Gulf Coast. Pages 33-47 *in:* S.A. Abbott (ed.). Annual Report of Survey-inventory Activities, July 1 1990 – June 30 1991. Brown Bear. Vol. XXII, Part V. Federal Aid in Wildlife Restoration Report, Project W-23-4, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Griffiths, W., and B.J. Gallaway. 1982. Prudhoe Bay Waterflood Project Fish Monitoring Program, 1981. Prepared by LGL Ecological Research Associates. Prepared for U.S. Army, Alaska District, Corps of Engineers, Anchorage, Alaska.

Griffiths, W.B. 1983. Fish. Pages 176-222 *in:* Environmental Characterization and Biological Use of Lagoons in the Eastern Beaufort Sea. Unpublished report prepared by LGL Ecological Research Associates, Inc. Available at NOAA/OCSEAP Office of Marine Pollution Assessment, Juneau, Alaska.

Griffiths, W.B., P.C. Craig, G.L. Walder, and G.J. Mann. 1975. Fisheries Investigations in the Coastal Region of the Beaufort Sea (Nunaluk Lagoon, N.W.T.). Arctic Gas Biological Report Series 34.

Griffiths, W.B., J. DenBeste, and P. Craig. 1977. Fisheries Investigations in a Coastal Region of the Beaufort Sea (Kaktovik Lagoon, Barter Island, Alaska). Arctic Gas Biological Report Series 40.

Griffiths, W.B., R.G. Fechhelm, B.J. Gallaway, L.R. Martin, and W.J. Wilson. 1998. Abundance of Selected Fish Species in Relation to Temperature and Salinity Patterns in the Sagavanirktok Delta, Alaska, Following Contruction of the Endicott Causeway. *Arctic* 51:94-104.

Griffiths, W.B., R.G. Fechhelm, L.R. Martin, and W.J. Wilson. 1996. The 1995 Endicott Development Fish Monitoring Program. Vol. I: Fish and Hydrography Data Report. Unpublished report prepared by LGL Alaska Research Associates, Inc. Available at BP Exploration (Alaska) Inc., Anchorage, Alaska.

Griffiths, W.B., R.G. Fechhelm, L.R. Martin, W.J. Wilson, and J.M. Colonell. 1995. The 1994 Endicott Development Fish Monitoring Program. Vol. I: Fish and Hydrography Data Report. Unpublished report by LGL Alaska Research Associates, Inc. Available at BP Exploration (Alaska) Inc., Anchorage, Alaska.

Griffiths, W.B., D.R. Schmidt, R.G. Fechhelm, and B.J. Gallaway. 1983. Fish Ecology. *in:* B. Britch and B. Gallaway (eds.). Environmental Summer Studies (1982) for the Endicott Development. Volume 3. Prepared by LGL Alaska Research Associates. Prepared for Sohio Alaska Petroleum Company, Anchorage, Alaska.

Groves, D.J., and B. Conant. 1998. Alaska Productivity Surveys of Geese, Swans, and Brant 1997. Unpublished report prepared by U.S. Fish and Wildlife Service, Migratory Bird Management, Juneau, Alaska.

Groves, D.J., B. Contant, R.J. King, J.I. Hodges, and J.G. King. 1996. Status and Trends of Loon Populations Summering in Alaska, 1971-1993. *Condor,* 98:189-195.

Gruening, E. 1968. The State of Alaska. Random House Press, New York, New York.

Gryder-Boutet, D.E. 1999. Sanitary Surveys, Class A & B Water Systems. Transmittal to Cash Faye, Alyeska Pipeline Service Company, Anchorage, Alaskas. Prepared by the Boutet Company. March 10, 1999.

Gubser, N.J. 1965. The Nunamiut Eskimos: Hunters of Caribou. Yale University Press, New Haven, Connecticut.

Gunn, A., and F.L. Miller. 1982. Muskox Bull Killed by a Barren-ground Grizzly Bear, Thelon Game Sanctuary, Northwest Territories. *Arctic*, 35:545-546.

Gustafson, J. 1977. An Evaluation of Low Water Crossings at Fish Streams Along the Trans-Alaska Pipeline System. Special Report No. 16.JFWAT, Anchorage, Alaska.

Haag, R.W., and L.C. Bliss. 1973. Energy Budget Changes Following Surface Disturbance to Upland Tundra. *Journal of Applied Ecology*, 10:356–374.

Hachmeister, L.E., D.R. Glass, and T.C. Cannon. 1991. Effects of Solid-fill Gravel Causeways on the Coastal Beaufort Sea. Pages 81-96 *in:* C.S. Benner and R.W. Middleton (eds.). Fisheries and Oil Development on the Continental Shelf. American Fisheries Society Symposium 11. American Fisheries Society, Bethesda, Maryland.

Hackney, D. 2000. Alyeska Pipeline Service Company, personal communication, November 20, 2000.

Haeussler, P.J., and G. Plafker. 1995. Earthquakes in Alaska, U.S. Geological Survey Report 95-64.

Haggarty, J.C., and C.B. Wooley. 1992. Draft Final Report of the Exxon Cultural Resource Program. Exxon Company, USA.

Haggarty, J.C., C. Wooley, J. Erlandson, and A. Crowell. 1991. The 1990 Exxon Cultural Resource Program: Site Protection and Maritime Cultural Ecology in Prince William Sound and the Gulf of Alaska. Exxon Company, USA.

Hall, E.R. 1981. The Mammals of North America. Second Edition. John Wiley & Sons, New York, New York.

Hall, E.S., Jr., and R. Gal. 1988. The United States Geological Survey–Bureau of Land Management Cultural Resources Program in the National Petroleum Reserve in Alaska, 1977–1981. U.S. Geological Survey Professional Paper, January 1, 1988.

Hall, E.S., Jr., S.C. Gerlach, and M.B. Blackman. 1985. In the National Interest: A Geographically Based Study of Anaktuvuk Pass Inupiat Subsistence Through Time. North Slope Borough, Barrow, Alaska.

Hall, J.D. 1979. A Survey of Cetaceans of Prince William Sound and Adjacent Vicinity – Their Numbers and Seasonal Movements. OCSEAP Annual Report 6:631-726.

Hamilton, C.I., S.J. Starr and L.L. Trasky. 1979. Recommendations for Minimizing the Impacts of Hydrocarbon Development on Fish, Wildlife and Aquatic Plant Resources of Lower Cook Inlet Vols. I and II. State of Alaska, Department of Fish and Game, Marine and Coastal Habitat Management, Anchorage, Alaska.

Hampton, P.D., and M.R. Joyce. 1985. Kuparuk Bird and Noise Study. Unpublished draft report prepared by Entrix, Inc. Prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, Alaska.

Hanson, D.K. 1999. Interim Report of Archaeological Activities at the Ringling Material Site (MS 71–2–020–5), Gulkana, Alaska. Office of History and Archaeology Report Number 76.

Hanson, W.C., and L.E. Eberhardt. 1981. Ecological Investigation of Alaskan Resource Development. *in:* Pacific Northwest Laboratory, Annual Report for 1980 to the Department of Energy, Assistant Secretary for Environment, Part 2. Ecological Sciences.

Hanson, W.C., and L.E. Eberhardt. 1982. Ecological Investigation of Alaskan Resource Development. *in:* Pacific Northwest Laboratory, Annual Report for 1981 to the Department of Energy, Assistant Secretary for Environment, Part 2. Ecological Sciences.

Harbo, S.J. 1958. An Investigation of Mink in Interior and Southeastern Alaska. M.S. thesis, University of Alaska, Fairbanks.

Harcharek, R. 1995. North Slope Borough 1993–1994 Economic Profile and Census Report Volume VII. George N. Ahmaogak, Sr., Mayor. North Slope Borough, Department of Planning and Community Services, Barrow, Alaska.

Harding, L., and J.A. Nagy. 1980. Responses of Grizzly Bears to Hydrocarbon Exploration on Richards Island, Northwest Territories, Canada. International Conference on Bear Research and Management 4:277-280.

Harfenist, A., A.P. Gilman, and K.I. Maus. 1990. The Effects of Exposure of Incubating Adult and Young Herring Gulls to a Simulated No. 2 Fuel Oil Slick. *Archives of Environmental Contamination and Toxicology*. 19:902-906.

Harington, C.R. 1966. Extralimited Occurrences of Walruses in the Canadian Arctic. *Journal of Mammalogy* 47(3):506-513.

Harkness, D. 1993. Game Management Units 11, 13D, 14A and 14C, Chugach Mountains. Pages 27-41 *in:* S.M. Abbott (ed.). Management Report of Survey-inventory Activities, 1July 1989 - 30 June 1992. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report, Grants W-23-3, W-23-4 and W-23-5, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

Harrison, J.G., and W.F.A. Buck. 1967. Peril in Perspective: an Account of the Medway Estuary Oil Pollution of September 1966. *Kent Bird Report* Special Supplement 16:1-24.

Hart Crowser Inc. 2000. Estimation of Oil Spill Risk from Alaska North Slope, Trans-Alaska Pipeline, and Arctic Canada Oil Spill Data Sets. Prepared for Minerals Management Service, Anchorage, Alaska. April 2000.

Hart, J., G. Powell, J. Maple, G. Stevick, and J.D. Norton. 1998. Fatigue Damage Calculations for Dented and Ovaled Section of the Trans-Alaska Pipeline System at Thompson Pass. International Pipeline Conference, Calgary, Alberta, Canada. June, 1998.

Harting, A.L. 1987. Road, Highway, Aircraft and Garbage Impacts. Pages 69-74 *in:* M.N. LeFranc, M.B. Moss, K.A.

Patnode and W.C. Sugg (eds.). Grizzly Bear Compendium, Sponsored by the Interagency Grizzly Bear Committee.

Hartley, D.R., D.H. Arner, and J.W. Lipe. 1984. A Comparison of Right-of-way Maintenance Treatments and Use by Wildlife. Pages 623-629 *in:* A.F. Crabtree (ed.). Proceedings of the Third International Symposium of Environmental Concerns in Rights-of-Way Management, 15-18 February 1982. Mississippi State University.

Harvey, J.T., and M.E. Dahlheim. 1994. Cetaceans in Oil. Pages 257-264 *in:* T.R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Harvey, S., J.G. Phillips, and P.J. Sharp. 1982. Reproductive Performance and Endocrine Responses to Ingested North Sea Oil. *In*: Aspects of Avian Endocrinology: Practical and Theoretical Implications. C.G. Scanes, A. Epple, and M.H. Stetson, (eds.) Graduate Studies 26, Texas Tech University, Lubbock, TX. pp. 379-395.

Harwood, L.A., S. Innes, P. Norton, and M.C.S. Kingsley. 1996. Distribution and Abundance of Beluga Whales in the MacKenzie Estuary, Southeast Beaufort Sea, and West Amundsen Gulf During Late July 1992. *Canadian Journal of Fisheries and Aquatic Sciences* 53:2262-2273.

Hassen, H. 1978. The Effect of European and American Contact on the Chugach Eskimo of Prince William Sound, Alaska 1741–1930. Ph.D. dissertation, University of Wisconsin, Milwaukee, Wisconsin.

Hatler, D.F. 1967. Some Aspects in the Ecology of the Black (*Ursus americanus*) in Interior Alaska. M.S. thesis, University of Alaska, Fairbanks.

Haugh, J.R. 1976. Population and Reproductive Changes in Alaskan Arctic Peregrines. *Canadian Field-Naturalist,* 90:359-361.

Hay, K.G., and B.A. Mohrman. 1993. Utility Corridors as Greenways: New Opportunities for Multiple Use and Public Support. Pages 367-370 *in:* G.J. Doucet, C. Seguin, and M. Giguere (eds.). Proceedings of the Fifth International Symposium on Environmental Concerns in Rights-of-Way Management, 19-22 September 1993.

Haynes, T., and S. Pedersen. 1989. Development and Subsistences. Alaska Department of Fish and Game 21(6):24–27.

Hechtel, J.L. 1991. Population Dynamics of Black Bear Populations, Fort Wainwright, Alaska. Final report prepared by Alaska Department of Fish and Game for the U.S. Army.

Heimer, W.E. 1980. A Summary of Dall Sheep Management in Alaska During 1979 (Or How to Cope with a Monumental Disaster). Biennial Symposium of the Northern Wild Sheep and Goat Council 3:355-383.

Heimer, W.E. 1985. Population Status and Management of Dall Sheep in Alaska, 1984. Pages 1-15 *in:* M. Hoefs (ed.). Wild Sheep Distribution, Abundance, Management, and Conservation of the Sheep of the World and Closely Related Mountain Ungulates. Special Report of the Nothern Wild Sheep and Goat Council. Yukon Wildlife Branch, Whitehorse, Yukon Territory, Canada.

Heinselman, M.L. 1978. Fire Intensity and Frequency as Factors in the Distribution and Structure of Northern Ecosystems. Pages 5-57 *in:* H.A. Mooney, T.M. Bonnicksen, J.L. Christensen, J.E. Lotan, and W.A. Reiners (eds.) Fire Regimes and Ecosystem Properties. General Technical Report WO-26. U.S. Forest Service, Washington D.C.

Helle, J.H. 1970. Biological Characteristics of Intertidal and Fresh-water Spawning Pink Salmon at Olsen Creek, Prince William Sound, Alaska, 1962-63. USFWS Special Science Report - Fisheries 602. U.S. Fish and Wildlife Service, Washington, D.C.

Helle, J.H., R.S. Williamson, and J.E. Bailey. 1964. Intertidal Ecology and Life History of Pink Salmon at Olsen Creek, Prince William Sound, Alaska. USFWS, Special Science Rport 483. U.S. Fish and Wildlife Service, Washington, D.C.

Helmericks, H. 2000. Long-time resident of the Colville River delta, personal communication.

Helmericks, J. 1990 and 1999. Long-time resident of the Colville River delta, personal communication.

Hemming, J.E., and K. Morehouse. 1976. Wildlife Atlas: Trans-Alaska Oil Pipeline, Prudhoe Bay to Valdez. Special Report No. 3. Joint State/Federal Fish and Wildlife Advisory Team, Anchorage, Alaska.

Hemming, C.R. 1988. Aquatic Habitat Evaluation of Flooded North Slope Gravel Mine Sites (1986-1987). Alaska Department of Fish and Game Technical Report 88-1. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

Hemming, C.R. 1990. Fisheries Investigations of Flooded North Slope Gravel Mine Sites, 1989. Alaska Department of Fish and Game Technical Report 90-2. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

Hemming, C.R. 1991. Fish and Habitat Investigations of Flooded North Slope Gravel Mine Sites. Alaska Department of Fish and Game Technical Report 91-3. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

Hemming, C.R. 1993. Tundra Stream Fish Habitat Investigations in the North Slope Oilfields. Alaska Department of Fish and Game Technical Report 93-1. Alaska Department of Fish and Game, Habitat and Restoration Division, Juneau, Alaska.

Hemming, C.R. 1994. Fisheries Enhancement Investigations in the Kuparuk River Oilfield, 1992. Alaska Department of Fish and Game Technical Report 94-4. Alaska Department of Fish and Game, Habitat and Restoration Division, Juneau, Alaska.

Hemming, C.R. 1995. Fisheries Enhancement Investigations in the Prudhoe Bay and Kuparuk River Oilfields, 1993. Alaska Department of Fish and Game Technical Report 95-3. Alaska Department of Fish and Game, Habitat and

Restoration Division, Juneau, Alaska.

Hemming, C.R. 1996. Fish Surveys of Selected Coastal Streams Sagavanirktok River to Bullen Point, 1995. Alaska Department of Fish and Game Technical Report 96-3. Alaska Department of Fish and Game, Juneau, Alaska.

Hemming, C.R., P.K. Webber, and J.F. Winters. 1989. Limnological and Fisheries Investigations of Flooded North Slope Gravel Mine Sites, 1988. Alaska Department of Fish and Game Technical Report 89-1. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.

Hickey, J.J. and D.W. Anderson. 1969. The Peregrine Falcon: Life History and Population Literature. Pages 3-41 *in*: J. Hickey (ed). Peregrine Falcon Populations: Their Biology and Decline. University of Wisconsin Press, Madison, Wisconsin.

Hickok, D.M. 1981. Environmental Aspects of Federal Efforts to Monitor Pipeline Operations in Alaska, Appendix III. Pages 61-68 *in:* Trans-Alaska Oil Pipeline Operations: More Federal Monitoring Needed, EMD-81-11. U.S. General Accounting Office, Gaithersburg, Massachusetts.

Hicks, M.V. 1995a. Game Management Unit 20A. Pages 24-26 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Moose. Federal Aid in Wildlife Restoration Progress Report, Grant W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1995b. Southcentral Alaska Deer Management, Game Management Unit 6. Page 5 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Progress Report, Grant 24-3, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M. V. 1995c. Brown bear. Management report of survey-inventory activities. 1 July 1992 - 30 June 1994. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1 and W-24-2. Study 4.0. Juneau, Alaska.

Hicks, M.V. 1995d. Furbearers. Management report of survey-inventory activities. 1 July 1991 - 30 June 1994. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-23-5, W-24-1, and W-24-2. Study 7.0. Juneau, Alaska.

Hicks, M.V. 1996a. Game Management Unit 6. Page 53 *in:* Annual Performance Report, Survey-inventory Activities, 1 July 1993 – 30 June 1995. Moose. Federal Aid in Wildlife Restoration Report, Grants W-24-2 and W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1996b. Game Management Unit 24. Page 33 *in:* Annual Performance Report, Survey-inventory Activities, 1 July 1993 – 30 June 1995. Moose. Federal Aid in Wildlife Restoration Report, Grant W-24-4, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1996c. Southcentral Alaska Deer Management, Game Management Unit 6. Page 5 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Progress Report, Grant 24-4, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V.. 1996d. Bison. Management report of survey-inventory activities. 1 July 1993 - 30 June 1995. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2 and W-24-3. Study 9.0. Juneau, Alaska.

Hicks, M.V. 1996e. Black Bear. Survey-inventory activities management report. 1 July 1992 - 30 June 1995. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1, W-24-2 and W-24-3. Study 17.0. Juneau, Alaska.

Hicks, M.V., ed. 1996f. Dall sheep. Management report of survey-inventory activities. 1 July 1992 - 30 June 1995. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1, W-24-2 and W-24-3. Study 6.0. Juneau, Alaska.

Hicks, M.V., ed. 1996g. Moose. Management report of survey-inventory activities. 1 July 1993 - 30 June 1995. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2 and W-24-3. Study 1.0. Juneau, Alaska.

Hicks, M.V., ed. 1996h. Caribou. Annual PerformanceReport of Survey-Inventory Activities. 1 July 1995-30 June 1996. Federal Aid in Wildlife Restoration, Projects W-24-4 and W-24-1, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1997a. Game Management Unit 20A. Pages 25-26 *in:* Annual Performance Report, Survey-inventory Activities, 1 July 1996 – 30 June 1997. Moose. Federal Aid in Wildlife Restoration Report, Grant W-24-5, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1997b. Game Mangements Unit 21D and 24, Galena Mountain, Wolf Mountain and Ray Mountains Caribou Herds. Pages 17-19 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1996 – 30 June 1997. Federal Aid in Wildlife Restoration Report. Grant W-24-5, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1997c. Southcentral Alaska Deer Management, Game Management Unit 6. Page 5 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Progress Report, Grant 24-5, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1997d. Caribou. Management report of survey-inventory activites. 1 July 1994 - 30 June 1996. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-3 and W-24-4. Study 3.0. Juneau, Alaska.

Hicks, M.V., ed. 1997e. Deer. Management report of survey-inventory activities. 1 July 1994 - 30 June 1996. Alaska

Department of Fish and Game, Fed. Aid in Wildl. Rest. Grants W-24-3 and W-24-4. Study 2.0. Juneau, Alaska.

Hicks, M.V., ed. 1997f. Wolf. Management report of survey-inventory activities. 1 July 1993 - 30 June 1996. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2, W-24-3, W-24-4. Study 14.0.

Hicks, M.V. 1998a. Game Management Unit 6. Page 8 *in:* Annual Performance Report, Survey-inventory Activities, 1 July 1997 – 30 June 1998. Moose. Federal Aid in Wildlife Restoration Report, Grant W-27-1, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998b. Game Management Unit 13. Pages 11-12 *in:* Federal Aid in Wildlife Restoration Annual Performance Report, Survey-inventory Activities, 1 July 1997 – 30 June 1998. Moose. Federal Aid in Wildlife Restoration Report, Grant W-27-1, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998c. Interior (Eastern Northslope) Muskox Population and Habitat Management 1997-98, Game Management Units 26B and 26C. Pages 1-2 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Muskox. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 16.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998d. Game Management Unit 20D, Delta Herd, Interior Bison Population and Habitat Management 1997-1998. Pages 3-5 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Bison. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998e. Southcentral Alaska Deer Management, Game Management Unit 6. Page 5 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998f. Game Management Unit 13D. Pages 8-9 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998g. Southcentral Alaska Mountain Goat Management, Game Management Unit 6. Page 5 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hicks, M.V. 1998h. Bison. Management report of survey-inventory activities. 1 July 1995 - 30 June 1997. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-4 and W-24-5. Study 9.0. Juneau, Alaska.

Hicks, M.V. 1998i. Bison. Survey-inventory activities annual performance report. 1 July 1997 - 30 June 1998. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1. Study 9.0. Juneau, Alaska.

Hicks, M.V. 1998j. Elk. Management report of survey-inventory activities. 1 July 1995 - 30 June 1997. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-4 and W-24-5. Study 13.0. Juneau, Alaska.

Hicks, M.V. 1998k. Elk. Survey-inventory activities annual performance report. 1 July 1997 - 30 June 1998. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1. Study 13.0. Juneau, Alaska.

Hicks, M.V. 1999a. Black bear. Survey-inventory activities annual performance report. 1 July 1998 - 30 June 1999. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grant W-27-2. Study 17.0. Juneau, Alaska.

Hicks, M.V. 1999b. Elk. Survey-inventory activities annual performance report. 1 July 1998 - 30 June 1999. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grant W-27-2. Study 13.0. Juneau, Alaska.

Hicks, M.V., ed. 1999c. Mountain Goat. Survey-inventory activities annual performance report. 1 July 1998 - 30 June 1999. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grant W-27-2. Study 12.0.

Hicks, M.V. 1999d. Muskox. Management report of survey-inventory activities. 1 July 1996 - 30 June 1998. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report, Grants W-24-5 and W-27-1. Study 16.0. 43 pp.

Higgs, A.S. 1998. Cultural Resources Reconnaissance Survey Report for Vault Creek and Marshall Dome. Letter-report prepared for Newmont Gold Company by Northern Land Use Research, Inc., Fairbanks, Alaska.

Hill, E.P. 1982. Beaver. Chapter 14 *in:* J.A. Chapman and G.A. Feldhamer (eds.). Wild Mammals of North America. John Hopkins University Press, Baltimore, Maryland.

Hines, A.H., and G.M. Ruiz. 2000. Biological Invasions of Cold-Water Coastal Ecosystems: Ballast Mediated Introductions in Port Valdez/Prince William Sound, Alaska, Final Project Report. Smithsonian Environmental Research Center, Edgewater, Maryland. March 15, 2000.

Hinman, R.A., ed. 1977. Black bear, brown bear, polar bear, and caribou. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Projects W-17-10, Jobs 3.0., 4.0, 5.0, 17.0, and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hinman, R.A., ed. 1979. Black bear, brown bear, polar bear, and caribou. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration,

Projects W-17-11,. Jobs 3.0., 4.0, 5.0, 17.0, and 22.0Alaska Department of Fish and Game, Juneau, Alaska.

Hinman, R.A., ed. 1980. Bison, caribou, moose, and muskoxen. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Projects W-17-8, Jobs 9.0, 3.0., 1.0, 16.0, and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hinman, R.A., ed. 1981. Caribou, moose and mountain goats. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Projects W-19-1 and W-19-2, Jobs 3.0, 1.0 and 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Hinzman, L.D., D.J. Goering, T.C. Kinney, and S. Li. 1997. Numeric Simulation of Thermokarst Formation During Disturbance. Pages 191-212 *in:* R.M.M. Crawford (ed.). Disturbance and Recovery in Arctic Lands, An Ecological Perspective. Kluwer Academic Publishers, Dordrecht, Netherlands.

Hobbie, J.E. 1982. Effects of Oil on Tundra Ponds and Streams. Final report DOE/EV/02989-2. U.S. Department of Energy, Energy Research and Development Administration, Washington D.C.

Hoffecker, J.F., W.R. Powers, and T. Goebel. 1993. The Colonization of Beringia and the Peopling of the New World. *Science* 259:46-52.

Hohenberger, C.J., D.P. Rudholm, and W.C. Hanson. 1981. 184. West coast tundra. *In:* Forty-fourth Breeding Bird Census. *American Birds* 35:95.

Holland, D. 2000. Former Alyeska employee who oversaw cleanup activities for most large pipeline spills, personal communication, March 10, 2000.

Holland, D.A. 1978. APSC memo from D.A. Holland to B.L. Hilliker regarding moose. March 13, 1978.

Holmes, C.E. 1996. Broken Mammoth. Pages 312–318 *in:* F.H. West (ed.). *American Beginnings: the Prehistory and Paleoecology of Beringia*. University of Chicago Press, Chicago, Illinois.

Holmes, C.E. 1998. New Data Pertaining to Swan Point, the Oldest Microblade Site Known in Alaska. *Current Research in the Pleistocene*, 15:21–22.

Holmes, C.E., and J.P. Cook. 1999. Tanana Valley Archaeology Circa 12,000 to 8,500 Years B.P. Paper presented at the Sixty-fourth Annual Meeting of the Society of American Archaeology.

Holmes, C.E., and R.J. Dale. 1988. Cultural Resources Survey of the Elliott Highway Milepost 73–154, 1987, Project 30441322. Office of History and Archaeology, Report No. 11. Alaska Division of Parks, Anchorage, Alaska.

Holmes, C.E., R. VanderHoek, and T.E. Dilley. 1996. Swan Point. Pages 319–323 *in:* F.H. West (ed.). American Beginnings. University of Chicago Press, Chicago, Illinois.

Holmes, W.N. 1985. Petroleum Pollutants in the Marine Environment and Some of Their Possible Effects on Hormonal Regulation in Marine Birds. Pages 201-211 *in*: The Endocrine System and the Environment. B.K. Follett, S. Ishii, and A. Chandola (eds.), Japan Science Society Press, Tokyo. Springer-Verlag, Berlin, Germany.

Holmes, W.N. and K.P. Cavenaugh. 1990. Some Evidence for an Effect of Ingested Petroleum on the Fertility of Mallard Drake (*Anas platyrhynchos*). *Archives of Environmental Contamination and Toxicology*. 19:898-901.

Hood, D.W., W.E. Shiels and E.J. Kelley. 1973. Environmental Studies of Port Valdez. Occasional Publication No. 3, Institute of Marine Science, University of Alaska, Fairbanks, Alaska.

Hooker, J.N. 1981. Oil Pipeline Energy Consumption and Efficiency. ORNL-5697. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Hooker, J.N. 1982. Oil Pipeline Energy Efficiency Studied for U.S. Pages 114 *et seq in: Oil & Gas Journal.*

Hoover, A.A. 1988a. Steller Sea Lion – *Eumetopias jubatus*. Pages 159–193 *in:* J.W. Lentfer (ed.). Selected Marine Mammals of Alaska. Marine Mammal Commission, Washington, D.C.

Hoover, A.A. 1988b. Harbor Seal – *Phoca vitulina*. Pages 125–158 *in:* J.W. Lentfer (ed.). Selected Marine Mammals of Alaska. Marine Mammal Commission, Washington, D.C.

Hoover-Miller, A., K.R. Parker, and J.J. Burns. 2001. A Reassessment of the Impact of the *Exxon Valdez* Oil Spill on Harbor Seals (*Phoca vitulina richardsi*) in Prince William Sound, Alaska. *Marine Mammal Science* 17:111-135.

Hopson, E. 1976. Mayor Eben Hopson's Warning to the People of the Canadian Arctic. Testimony to the Berger Commission.

Hopson, E. 1978. Mayor Eben Hopson's Testimony. Public Hearing on Proposed Pt. Thompson Lease Sale, July 25, 1978.

Horejsi, B.L. 1981. Behavioral Response of Barren Ground Caribou to a Moving Vehicle. *Arctic*, 34:180-185.

Hornocker, M.G., and H.S. Hash. 1981. Ecology of the Wolverine in Northwestern Montana. *Canadian Journal of Zoology*, 59:1286-1301.

Hosley, E.H. 1981. Intercultural Relations and Culture Change in the Alaska Plateau. Pages 546–555 *in*: J. Helm (ed.). Handbook of the North American Indian: Subarctic. Vol. 6. Smithsonian Institution, Washington, D.C.

Howe, A.L., G. Fidler, C. Olnes, A.E. Bingham, and M.J. Mills. 1998. Harvest, Catch and Participation in Alaska Sport Fisheries During 1997. Fisheries Data Series 98-25. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage, Alaska.

Hughes, M.R., C. Kassera, and B.R. Thomas. 1990. Effect of Externally Applied Bunker Fuel on Body Mass and Temperature, Plasma Concentration and Water Flux of Glaucous-Winged Gulls, *Larus glaucescens. Canadian Journal of Zoology*. 68:716-721.

Hull, T., and L. Leask. 2000. Dividing Alaska, 1867-2000:

Changing Land Ownership and Management. *Alaska Review of Social and Economic Conditions*, Volume XXXII, No. 1. University of Alaska, Anchorage, Institute of Social and Economic Research, Anchorage, Alaska.

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, California.

Hundertmark, K.J. 1997. Home Range, Dispersal and Migration. Pages 303-335 *in:* A.W. Franzmann and C.C. Schwartz (eds.). Ecology and Management of the North American Moose. Wildlife Management Institute and Smithsonian Institution Press, Washington, D.C.

Hunter, B. 1999. Alaska Department of Fish and Game, personal communication, October 30, 1999.

Hurst, G. 1997. Project Habitat: ROW Management to Enhance Wildlife Habitat and Utility Image. Pages 311-316 *in:* J.R. Williams et al. (eds.). Proceedings of the Sixth International Symposium on Environmental Concerns in Rights-of-Way Management, 24-26 February 1997. New Orleans, Louisiana.

Huskey, L. 1979. Analysis of Cumulative Impacts, Western Gulf of Alaska Impact Analysis. Technical Memo 39. Bureau of Land Management, Alaska OCS Office.

Huskey, L. 1995. The Petroleum Industry and the Fairbanks Economy. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

HWLF Inc. 1998. Fischer-Tropsch Technology. Howard, Weil, Labouisse, and Friedrichs, Inc., Houston, Texas.

IAI. 1988. Village Economies in Rural Alaska. Alaska OCS Environmental Studies Program Technical Report 132. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

IAI. 1989. Point Lay Case Study. Social and Economic Studies Program Technical Report No. 139. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

IAI. 1990a. Subsistence Resource Harvest Patterns: Kaktovik. Social and Economic Studies Program Special Report No. 9. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

IAI. 1990b. Subsistence Resource Harvest Patterns: Nuiqsut. Social and Economic Studies Program Special Report No. 8. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

IAI. 1990c. Northern Institutional Profile Analysis: Beautfort Sea. Social and Economic Studies Program Technical Report No. 142. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

IAI. 1990d. Economic, Social, and Psychological Impact Assessment of the Exxon Valdez Oil Spill. Prepared for the Oiled Mayors Subcommittee, Alaska Conference of Mayors, November 1990.

INEEL. 1999. Draft. North Slope of Alaska Natural Gas Resource Development and Utilization Study. Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho.

Ingstad, H. 1954. Nunamiut: Among Alaska's Inland Eskimos. W. W. Norton & Company, Inc., New York, New York.

Irving, L., G.C. West, L.J. Peyton, and S. Paneak. 1967. Migration of Willow Ptarmigan (*Lagopus lagopus*) in Arctic Alaska. *Arctic*, 20:77-85.

Irving, W.N. 1964. Punyik Point and the Arctic Small Tool Tradition. Ph.D. dissertation, University of Wisconsin, Madison.

ISER. 1999. Evaluation of the Alaska Nature Health Board Sanitation Facility Operation and Maintenance Program. Prepared for Alaska Native Health Board and U.S. Environmental Protection Agency.

Isleib, M.E., and B. Kessel. 1973. Birds of the North Gulf Coast - Prince William Sound Region, Alaska. Biological Papers, University of Alaska No. 14. (Reprinted in 1979 with updated appendix.)

Isleib, M.E. 1979. Migrating Shorebird Populations on the Copper River Delta and Eastern Prince William Sound, Alaska. *Studies in Avian Biology* 2:125-129.

Jackson, M.D., and A.M. White. 2000. Mainline Valve Testing on the Trans-Alaska Pipeline System, ETCE/OMAE.

Jakimchuk, R.D., S.H. Ferguson, and L.G. Sopuck. 1987. Differential Habitat Use and Sexual Segregation in the Central Arctic Caribou Herd. *Canadian Journal of Zoology*, 65:534-541.

Jakimchuk, R.D., D.J. Vernam, and L.G. Sopuck. 1984. The Relationship Between Dall Sheep and the Trans-Alaska Pipeline in the Northern Brooks Range. Prepared by Renewable Resources Consulting Services, Ltd. Sidney, British Columbia, Canada. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska.

James, A.R.C. and A.K. Stuart-Smith. 2000 Distribution of Caribou and Wolves in Relation to Linear Corridors. *Journal of Wildlife Management*, 64:154-159.

James, D. 1996. Interior Furbearer Population Management. Pages 15-24 *in:* M.V. Hicks (ed.). Furbearers. Annual Performance Report of Survey-inventory Activities, 1 July 1995-30 June 1996. Federal Aid in Wildlife Restoration Report, Grant W-24-4, Study 7.0. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

James, D. 1997a. Interior Caribou Population and Habitat Management, Game. Pages 11-21 *in:* M.V. Hicks (ed.). Annual Performance Report Survey-inventory Activities, 1 July 1996 – 30 June 1997. Caribou. Federal Aid in Wildlife Restoration Progress Report, Grant W-25-5, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

James, D. 1997b. Interior Wolf Population and Habitat Management. Pages 11-18 *in:* M.V. Hicks (ed.). Annual Performance Report of Survey-inventory Activities, 1 July 1996 – 30 June 1997. Wolf. Federal Aid in Wildlife Restoration Report, Grant W-24-5, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Jarrel, G.H., S.O. MacDonald, and J.A. Cook. 1998. Checklist of recent mammals of Alaska. University of Alaska Museum, Fairbanks, Alaska. From web site: www.uaf.edu/museum/mammal/AK_Mammals/Checklist.html

Jeffrey, D.E. 1993. Ecotourism Potential of Abandoned and Deserted Corridors, Halifax County, Nova Scotia (abstract). Page 548 *in:* G.J. Doucet, C. Seguin, and M. Giguere (eds.). Proceedings of the Fifth International Symposium on Environmental Concerns in Rights-of-Way Management, 19-22 September 1993.

Jenkins, S.H., and P.E. Busher. 1979. *Castor canadensis*. Mammalian Species No. 120, American Society of Mammalogists.

Jennings, L.B. 1981. Game Management Unit 20. Pages 40-41 and 83-84 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities. Part 1, Black Bears and Brown Bears. Federal Aid in Wildlife Restoration Progress Report, Projects W-19-1 and W-19-2, Jobs 17.0, 4.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Jingfors, K.T., and D.R. Klein. 1982. Productivity in Recently Established Muskox Populations in Alaska. *Journal of Wildlife Management,* 46:1092-1096.

JMM. 1990. Environmental Evaluation for the Atigun Pipeline Replacement Project. Final report prepared for Alyeska Pipeline Service Company. James M. Montgomery Consulting Engineers, Anchorage, Alaska.

John, L. 1959. How Stevens Village Came to Be. *Alaska Sportsman,* 25:32-34.

Johnson, A., and S. Kubanis. 1980. The Revegetation of Disturbed Sites Along the Yukon River to Prudhoe Bay Haul Road. Pages 16-29 *in:* C. Jackson and M. Schuster (eds.). Proceedings: High Altitude Revegetation Workshop No. 4, Colorado School of Mines, Golden, Colorado.

Johnson, C.B. 1985. Use of Coastal Habitat by Mink on Prince of Wales Island, Alaska. M.S. thesis, University of Alaska, Fairbanks.

Johnson, C.B., and D.L. Garshelis. 1995. Sea Otter Abundance, Distribution, and Pup Production in Prince William Sound Following the *Exxon Valdez* Oil Spill. Pages 894-929 *in:* P.G. Wells, J.N. Butler, and J.S. Hughes (eds.). *Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Johnson, C.B., and B.E. Lawhead. 1989. Distribution, Movements, and Behavior of Caribou in the Kuparuk Oilfield, Summer 1988. Final report prepared for ARCO Alaska, Inc. and the Kuparuk River Unit, Anchorage, Alaska.

Johnson, C.B., M.T. Jorgenson, R.M. Burgess, B.E. Lawhead, J.R. Rose, and A.A. Stickney. 1996. Wildlife Studies on the Colville River Delta, Alaska, 1995. Fourth Annual Report. Prepared by ABR, Inc., Fairbanks, Alaska. Prepared for ARCO Alaska, Inc., and Kuukpik Unit Owners, Anchorage, Alaska.

Johnson, C.B., B.E. Lawhead, J.R. Rose, J.E. Roth, S.F. Schleutner, A.A. Stickney, and A.M. Wildman. 2000. Alpine Avian Monitoring Report, 1999. Second Annual Report. Prepared by ABR, Inc., for Phillips Alaska Inc. and Anadarko Petroleum Corporation, Anchorage, Alaska.

Johnson, C.B., B.E. Lawhead, J.R. Rose, M.D. Smith, A.A. Stickney, and A.M. Wildman. 1998. Wildlife Studies on the Colville River Delta, Alaska, 1997. Sixth Annual Report. Prepared by ABR, Inc., Fairbanks, Alaska. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Johnson, C.B., B.E. Lawhead, J.R. Rose, A.A. Stickney, and A.M. Wildman. 1997. Wildlife Studies on the Colville River Delta, Alaska, 1996. Fifth Annual Report. Prepared by ABR, Inc., Fairbanks, Alaska. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Johnson, D.M. 1982. Game Management Units 13 and 20, Delta Management Area. Pages 69-70 *in:* R.A. Hinman, (ed.). Annual Report of Survey-inventory Activities. Volume XII, Part III. Bison, Deer, Elk, Muskoxen and Sheep. Federal Aid in Wildlife Restoration Progress Report, Projects W-19-1 and W-19-2, Jobs 9.0, 2.0, 13.0, 16.0, and 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

Johnson, E. 1999. Alyeska Pipeline Service Company, Fairbanks, Alaska, personal communication, December 12, 1999.

Johnson, E. and T. Bieri. 1998. Economic Justification for Cathodic Protection Based on Pig Data. Corrosion/98 NACE paper no. 79.

Johnson, J. 2000. Alyeska Pipeline Service Company, personal communication.

Johnson, J.F.C. (ed.). 1984. Chugach Legends and Photographs of the Chugach Region. Chugach Alaska Corporation, Anchorage, Alaska.

Johnson, L.A. 1981. Revegetation and Selected Terrain Disturbances Along the Trans-Alaska Pipeline, 1975-1978. CRREL Report 81-12. U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Johnson, L.A. 1987. Management of Northern Gravel Sites for Successful Reclamation: A Review. *Arctic and Alpine Research,* 19:530-536.

Johnson, S.R. 1982. Continuing Investigations of Oldsquaws (*Clangula hyemalis* L.) During the Molt Period in the Alaskan Beaufort Sea. Pages 547-563 *in:* Environmental Assessment Alaskan Continental Shelf Final Report Principal Investment Volume 23. Bureau of Land Management and National Oceanographic and Atmospheric Adminstration, OSCEAP, Juneau, Alaska.

Johnson, S.R. 1983. Investigations of Nesting and Molting Birds in the Vicinity of Long Island, Alaska. Prepared by LGL Alaska Research Associates, Inc. Prepared for Shell Oil Company, Houston, Texas.

Johnson, S.R. 1984. Habitat Use and Behavior of Nesting

Common Eiders and Molting Oldsquaws at Thetis Island, Alaska During a Period of Industrial Activity. Prepared by LGL Alaska Research Associates, Inc. Prepared for Sohio Alaska Petroleum Company, Anchorage, Alaska.

Johnson, S.R. 1990a. Colonization and Habitat Use by Pacific Eiders (*Somateria mollissima v-nigra*) on the Endicott Causeway, Beaufort Sea, Alaska, 1989. Prepared by LGL Alaska Research Associates, Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Johnson, S.R. 1990b. Monitoring Beaufort Sea Waterfowl and Marine Birds. Prepared by LGL Alaska Research Associates, Inc. Prepared for U.S. Minerals Management Service, Alaska Outer Continental Shelf Region, Anchorage, Alaska.

Johnson, S.R. 1991. The Status of Snow Geese in the Sagavanirktok River Delta, Alaska: A 12-year Summary Report: 1980-1991. Unpublished report prepared by LGL Alaska Research Assoc., Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Johnson, S.R. 1998. Distribution and Movements of Brood-rearing Lesser Snow Geese in Relation to Petroleum Develoment in Arctic Alaska. *Arctic,* 51:336-344.

Johnson, S.R. 2000a. Lesser Snow Goose. Pages 233-257 *in:* J.C. Truett and S.R. Johnson (eds.). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Johnson, S.R. 2000b. Pacific Eider. Pages 259-275 *in:* J.C. Truett and S.R. Johnson (eds.). Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Johnson, S.R., and D.R. Herter. 1989. The Birds of the Beaufort Sea. BP Exploration (Alaska) Inc., Anchorage, Alaska.

Johnson, S.R., D.R. Herter and M.S.W. Bradstreet. 1987. Habitat Use and Reproductive Success of Pacific Eiders (*Somateria mollisima v-nigra*) During a Period of Industrial Activity. *Biological Conservation,* 41:77-90.

Johnson, S.R., D.A. Wiggins, and R.J. Rodrigues. 1993. Use of Gravel Causeways by Nesting Common Eiders, Beaufort Sea, Alaska, 1992. Unpublished report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Jokela, B. 1990. Water Quality Considerations. Pages 349-369 *in:* Ryan and Crissman (ed.). Cold Regions Hydrology and Hydraulics. Technical Council on Cold Regions Engineering Monograph, ASCE. New York, New York.

Jones, S.H., and C.B. Fahl. 1994. Magnitude and Frequency of Floods in Alaska and Conterminous Basins of Canada. U.S. Geological Survey, Water-Resources Investigations, Report 93-4179. Prepared in cooperation with the State of Alaska and Federal Highway Administration. U.S. Geological Survey, Anchorage, Alaska.

Jorgensen, J. 1996. Ethnicity, Not Culture? Obfuscating Social Science in the *Exxon Valdez* Oil Spill Case. American Indian Culture and Research Journal. University of California, Los Angeles, California.

Jorgensen, J.G. 1990. Oil Age Eskimos. University of California Press, Berkeley, California.

Jorgenson, M.T. 1984. The Response of Vegetation to Landscape Evolution on Glacial Till Near Toolik Lake, Alaska. Pages 134-142 *in:* Inventorying Forest and Other Vegetation of the High Latitude and High Altitude Regions: Proceedings of an International Symposium, Society of American Foresters Regional Technical Conference, Fairbanks, Alaska. Society of American Foresters, Bethesda, Maryland.

Jorgenson, M.T. 1986. Biophysical Factors Affecting the Geographic Variability of Soil Heat Flux. M.S. thesis, University of Alaska, Fairbanks.

Jorgenson, M.T., and T.C. Cater. 1991. Land Rehabilitation Studies in the Kuparuk Oilfield, Alaska, 1990. Unpublished annual report prepared by Alaska Biological Research, Inc. Prepared for ARCO Alaska, Anchorage, Alaska.

Jorgenson, M.T., and T.C. Cater. 1996. Minimizing Ecological Damage During Cleanup of Terrestrial and Wetland Oil Spills. Chapter 10 *in:* P. Cheremisinoff, (ed.). Storage Tanks. Environmental Control Technology, Gulf Publishing Company, Houston, Texas.

Jorgenson, M.T., and M.R. Joyce. 1994. Six Strategies for Rehabilitating Land Disturbed by Oil Development in the Arctic Alaska. *Arctic*, 47:374-390.

Jorgenson, M.T., L.W. Krizan, and M.R. Joyce. 1991. Bioremediation and Tundra Restoration After an Oil Spill in the Kuparuk Oilfield, Alaska, 1990. Pages 149-154 *in:* Proceedings of the 14th Annual Arctic and Marine Oil Spill Technical Program, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Jorgenson, M.T., J. Roth, M. Raynolds, M.D. Smith, W. Lentz, A. Zusi-Cobb, and C.H. Racine. 1999. Ecological Land Survey for Fort Wainwright, Alaska. Pages *in:* CRREL Report 99-9. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Jorgenson, M.T., Y. Shur, and H.J. Walker. 1998. Factors Affecting Evolution of a Permafrost Dominated Landscape on the Colville River Delta, Northern Alaska. Pages 523-530 *in:* A.G. Lewkowicz, and M. Allard (eds.). Proceedings of Seventh International Permafrost Conference. Collection Nordicana, No. 57, Universite Laval, Sainte-Foy, Quebec, Canada.

JPO. 1997. Audit Report, Compliance and Effectiveness of Alyeska Pipeline Service Company’s Program to Implement the Alaska Native Utilization Agreement of October 20, 1995. Joint Pipeline Office, Anchorage, Alaska.

JSFFWAT. 1977. List of Designated Wildlife Crossings for the Trans-Alaska Oil Pipeline. Special Report No. 11A. Joint State/Federal Fish and Wildlife Advisory Team, Anchorage, Alaska.

Kancewick, M., and E. Smith. 1991. Subsistence in Alaska: Towards a Native Priority. *UMKC Law Review*, 59(3):645–677.

Kari, J. 1977. Linguistic Differences Between Tanaina and Ahtna. *International Journal of Linguistics*, 34(4):274-288.

Karter, A.J., and I. Folstad. 1989. Defence Behaviour of Reindeer in Response to Flying Parasitic Diptera. *Rangifer,* 9:14-16.

Kavanagh, N., and A. Townsend. 1977. Construction Related Oil Spills Along Trans-Alaska Pipeline. Special Report No. 15. Joint State/Federal Fish and Wildlife Advisory Team, Anchorage, Alaska.

Kawamura, A. 1980. A Review of the Food of Balaenopterid Whales. The Scientific Reports of the Whales Research Institute 32:155–197.

Keeble, J. 1991. Out of the Channel: the Exxon Valdez Oil Spill in Prince William Sound. HarperCollins Publishers, New York, New York.

Kellogg, G. 2000. U.S. Environmental Protection Agency, Anchorage, Alaska, personal communication, November 2000.

Kelly, B.P. 1988. Ringed Seal. Pages 57-55 *in:* J.W. Lentfer (ed.). Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Marine Mammal Commission. Washington, D.C.

Kelsall, J.P. 1968. The Caribou. Canada Wildlife Service Monograph No. 3, Ottawa, Ontario, Canada.

Kelso, D. 1981. Technical Overview of the State's Subsistence Program. Technical Paper Series. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Kelso, D. 1982. Subsistence Use of Fish and Game Resources in Alaska: Considerations in Forming Effective Management Policies. Technical Paper Series. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Kemp, A., and L. Stephan. 1997. Economic and Fiscal Aspects of Decommissioning Offshore Structures. *in:* D.G. Gorman and J. Neilson (eds.). Decommissioning Offshore Structures. Springer-Verlog, London, England.

Kennedy, J.L. 1993. Oil and Gas Pipeline Fundamentals. Second edition. PennWell Publishing Co., Tulsa, Oklahoma.

Kenyon, K.W. 1969. The Sea Otter in the Eastern Pacific Ocean. North American Fauna, Vol. 68. Government Printing Office, Washington, D.C.

Kertell, K. 1991. Disappearance of the Steller's Eider from the Yukon–Kuskokwim Delta, Alaska. *Arctic,* 44:177–187.

Kertell, K. 1993. Macroinvertebrate Production and Waterbird Use of Natural Ponds and Impoundments in the Prudhoe Bay Oil Fields, Alaska. Unpublished report prepared by LGL Alaska Research Associates, Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Kertell, K. 1994. Water Quality and Pacific Loon Breeding Biology on Natural Ponds and Impoundments in the Prudhoe Bay Oil Field, Alaska. Unpublished report by LGL Alaska Research Associates, Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Kertell, K., and R. Howard. 1992. Secondary Productivity of Impounded Wetlands in the Prudhoe Bay Oil Field: Implications for Waterbirds. Unpublished report prepared by LGL Alaska Research Associates, Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Kessel, B. 1984. Migration of Sandhill Cranes, *Grus canadensis*, in East-central Alaska, with Routes Through Alaska and Western Canada. *Canadian Field-Naturalist*, 98:279-292.

Kessel, B., and D.D. Gibson. 1978. Status and Distribution of Alaska Birds. Studies in Avian Biology. Cooper Ornithological Society, Allen Press, Lawrence, Kansas.

Kesterson, M.B. 1988. Lynx Home Range and Spatial Organization in Relation to Population Density and Prey Abundance. M.S. thesis, University of Alaska, Fairbanks.

Ketz, J.A. 1983. Paxson Lake: Two Nineteenth Century Sites in the Copper River Basin, Alaska. Occasional Paper 33. Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska, Fairbanks, Alaska.

Ketz, J.A., and K.L. Arndt. 1987. The Russian American Company and the Development of the Alaska Copper River Fur Trade. Pages 438–455 *in:* B.G. Trigger, T. Morantz, and L. Dechene (eds.). Le Castor Fait Tout: Selected Papers of the Fifth North American Fur Trade Conference, 1985. Lake Louise Historical Society, Montreal, Ontario, Canada.

Kidd, J.G., and L.J. Rossow. 1998. Land Rehabilitation Studies in the Prudhoe Bay Oilfield, Alaska, 1997. Final report prepared by ABR, Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Kidd, J.G., M.T. Jorgenson, L.L. Jacobs, and T.C. Cater. 1995. Ecological Restoration of the North Prudhoe Bay State No. 2 Exploratory Well Site, Prudhoe Bay Oil Field, Alaska, 1993, Second Annual Report. Prepared by Alaska Biological Research. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Kiker, E.B., and P.C. Fielder. 1980. A Bison Management Plan for Fort Greely, Alaska. U.S. Army, Fort Greely and Fort Richardson, Alaska.

King, J.G., and C.P. Dau. 1981. Waterfowl and Their Habitats in the Eastern Bering Sea. Pages 739–753 *in:* D.W. Hood and J.A. Calder (eds.). The Eastern Bering Sea Shelf: Oceanography and Resources. Vol. 2. National Oceanographic and Atmospheric Administration, Office of Marine Pollution Assessment, Juneau, Alaska.

King, K.A. and C.A. LeFever. 1979. Effects of Oil Transferred from Incubating Gulls to their Eggs. *Marine Pollution Bulletin* 10:319-320.

Kirchhoff, M.D. 1997. Effects of Selection Logging on Deer Habitat in Southeast Alaska. Federal Aid in Wildlife Restoration Research Progress Report, Projects W-24-4 and

24-5, Study 2.11. Alaska Department of Fish and Game, Juneaua, Alaska.

Kitigawa, J. 2000. Valdez Marine Terminal Ballast Water Treatment Plant: Compliance with Agreement and Grant Section 23. TAPS Engineering Report. JP No. 00-E-018.

Kizzia, T. 1990. Spill Shy BP Avoids Inlet Refinery. Page C1 *in:* Anchorage Daily News. February 10, 1990.

Klausner, S.Z., and E.F. Foulks. 1982. Eskimo Capitalists: Oil, Politics, and Alcohol. Allanheld, Osmun and Company, Totowa, New Jersey.

Klechka, E. 1999. Alyeska Pipeline Service Company, personal communication, December 13, 1999.

Klein, D.R. 1965. Postglacial Distribution Patterns of Mammals in the Southern Coastal Regions of Alaska. *Journal of Arctic Institute of North America*, 18:7-20.

Klein, D.R. 1974. Reaction of Wildlife to Aircraft Disturbance. Alaska Co-operative Wildlife Research Unit, Fairbanks, Alaska Quarterly Report 25:18-22.

Klein, D.R. 1991a. Adaptations of Game Species to the Environment Changed by Man; Convener's Report. Pages 375-378 *in:* B. Bobek, K. Peranowski, and W. Regelin (eds.). Global Trends in Wildlife Management. Transactions of the 18th International Union of Game Biologists Congress, Krakow, Poland.

Klein, D.R. 1991b. Caribou in the Changing North. *Applied Animal Behaviour Science,* 29:279-291.

Klein, D.R. 2000. The Muskox. Pages 545-558 *in:* S. Demaris and P. R. Krausman (eds.). Ecology and Management of Large Mammals in North America. Prentice-Hall, Inc., New Jersey.

Klein, D.R., and C. Bay. 1994. Resource Partitioning by Mammalian Herbivores in the High Arctic. *Oecologia,* 97:439-450.

Klein, D.R., G.D. Yakushkin, and E.B. Pospelova. 1993. Comparative Habitat Selection by Muskoxen Introduced to Northeastern Alaska and the Taimyr Peninsula, Russia. *Rangifer,* 13:21-25.

Klinger, L.F., D.A. Walker, and P.J. Weber. 1983. The Effects of Gravel Roads on Alaskan Arctic Coastal Plain Tundra. Pages 628-633 *in:* Permafrost Fourth International Conference Proceedings. National Academy Press, Washington, D.C.

Knapp, G., and T. Smith. 1991. The Alaska Seafood Industry. Prepared for Alaska Industrial Development and Export Authority and Alaska Department of Commerce and Economic Development.

Knight, R.L., and D.N. Cole. 1991. Effects of Recreational Activity on Wildlife in Wildlands. Transactions of the North American Wildlife and Natural Resource Conference 56:238-247.

Kohut, R.J., J.A. Laurence, P. King, R. Raba, and A.J. Belsky. 1994. Assessment of the Effects of Air Quality on Arctic Tundra Vegetation at Prudhoe Bay, Alaska. Final report prepared for the Alaska Oil and Gas Association.

Kraeger, R.H. 1976. Right-of-Way Restoration: Mitigating the Impact. Pages 241-244 *in:* R. Tillman (ed.). Proceedings of the First National Symposium of Environmental Concerns in Rights-of-Way Management, 6-8 January 1976. Mississippi State University.

Krausman, P.R., and J.J. Hervert. 1983. Mountain Sheep Responses to Aerial Surveys. *Wildlife Society Bulletin,* 11:372-375.

Kreig, R.A., and R.D. Reger. 1982. Air-photo Analysis and Summary of Landform Soil Properties Along the Route of the Trans-Alaska Pipeline System. Geologic Report 66149. Alaska Division of Geological and Geophysical Surveys.

Kresge, D.T., and D. Seiver. 1978. Planning for a Resource-Rich Region: The Case of Alaska. *American Economic Review,* 68(2):99–104.

Kresge, D.T., T.A. Morehouse, and G.W. Rogers. 1977. Issues in Alaska Development. University of Washington Press, Seattle, Washington.

Kresge, D.T., D. Seiver, O.S. Goldsmith, and M. Scott. 1984. Regions and Resources: Strategies for Development. Massachusetts Institute of Technology Press, Cambridge, Massachusetts.

Krogman, B., D. Rugh, R. Sonntag, J. Zeh, and D. Ko. 1989. Ice-based Census of Bowhead Whales Migrating Past Point Barrow, Alaska, 1978-1983. *Marine Mammal Science* 5:116-138.

Kruse, J. 1976. Research Notes: Fairbanks Community Survey. Institute of Social and Economic Research, Fairbanks, Alaska.

Kruse, J. 1984. Changes in the Well-Being of Alaska Natives Since ANCSA. Alaska Review of Social and Economic Conditions.

Kruse, J. 1991. Alaska Inupiat Subsistence and Wage Employment Patterns: Understanding Individual Choice. *Human Organization,* Vol. 50, No. 4.

Kruse, J., J. Klienfeld, and R. Travis. 1981. Energy Development and the North Slope Inupiat: Quantitative Analysis of Social and Economic Change. Man in the Arctic Monograph No. 1, ISER Report Series No. 49. Institute of Social and Economic Research, Fairbanks, Alaska and University of Alaska, Anchorage.

Kruse, J.A. 1982. Subsistence and the North Slope Inupiat: The Effects of Energy Development. Man in the Arctic Monograph No. 4, ISER Report Series No. 56. Institute of Social and Economic Research and University of Alaska, Anchorage.

Kruse, J.A., M. Baring–Gould, W. Schneider, J. Gross, J.G. Knapp, and G. Sherrod. 1983. A Description of the Socioeconomics of the North Slope Borough. Technical Report No. 85.

Kunz, M. 2000. Archaeologist, Bureau of Land Management, personal communication.Telephone conversation, November 16, 2000.

Kunz, H.L., and R.E. Reanier. 1994. Paleoindians in Beringia: Evidence from Arctic Alaska. *Science* 263:660-662.

Labar, I. 1995. The Shrinking American Tanker Fleet. *Professional Mariner,* 14:27–31.

LaBelle, R.P., and C.M. Anderson. 1985. The Application of Oceanography to Oil-spill Modeling for Outer Continental Shelf Oil and Gas Leasing Program. *Marine Technology Society Journal,* 19(2):19–26.

Lanctot, R., G. Goatcher, K. Scribner, S. Talbot, B. Pierson, D. Esler, and D. Zwiefelhofer. 1999. Harlequin Duck Recovery from the *Exxon Valdez* Oil Spill: A Population Genetics Perspective. *Auk,* 116:781-791.

Lanfear, K.J., and D.A. Amstutz. 1983. A Reexamination of Occurrence Rates for Accidental Oilspills on the U.S. Outer Continental Shelf. Pages 355–9 *in:* Proceedings of Eighth Conference on the Prevention, Behavior, Control, and Cleanup of Oilspills. San Antonio, Texas.

Langdon, S., and R. Worl. 1981. Distribution and Exchange of Subsistence Resources in Alaska. Prepared for the U.S. Fish and Wildlife Service. University of Alaska, Arctic Environmental Information and Data Center, Anchorage, Alaska.

Larivière, S. 1999. *Mustela vison*. Mammalian Species No. 608. American Society of Mammalogists.

Larivière, S., and L.R. Walton. 1998. *Lontra canadensis*. Mammalian Species No. 587. American Society of Mammalogists.

Larned, B., T. Tiplady, R. Platte, and R.Stehn. 1999. Eider Breeding Population Survey Arctic Coastal Plain, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Larsen, D.N. 1983. Habitats, Movements, and Foods of River Otters in Coastal Southeastern Alaska. M.S. thesis, University of Alaska, Fairbanks.

Larsen. R.W. 1979. Delta Management Area Survey and Inventory Report. Pages 42-43 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities. Part IV. Sheep. Vol. IX. Federal Aid in Wildlife Restoration Progress Report, Project W-17-10. Alaska Department of Fish and Game, Juneau, Alaska.

Lawhead, B.E. 1988. Distribution and Movements of Central Arctic Herd Caribou During the Calving and Insect Seasons. Pages 8-13 *in:* R.D. Cameron and J.L. Davis (eds.). Reproduction and Calf Survival. Wildlife Technical Bulletin No. 8:196-210. Alaska Department of Fish and Game, Juneau, Alaska.

Lawhead, B.E. 1997. Caribou and Oil Development in Northern Alaska: Lessons from the Central Arctic Herd. Pages 7-5 – 7-8 *in:* T. Newbury, Symposium Coordinator. Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve-Alaska, NPR-A Symposium Proceedings.

Lawhead, B.E., and R.D. Cameron. 1988. Caribou Distribution on the Calving Grounds of the Central Arctic Herd, 1987. Unpublished report prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Lawhead, B.E., and C.B. Johnson. 2000. Surveys of caribou and muskoxen in the Kuparuk-Colville region, Alaska, 1999, with a summary of caribou calving distribution since 1993. Final report prepared for PHILLIPS Alaska, Inc. and Kuparuk River Unit, Anchorage, Alaska.

Lawhead, B.E., L.C. Byrne, and C.B. Johnson. 1993. Caribou Synthesis, 1987-1990. 1990 Endicott Environmental Monitoring Program Final Report, Vol. V. [released Mar. 1994]. U.S. Army Corps of Engineers, Alaska District, Anchorage. Final report prepared for Science Applications International Corp., Anchorage, Alaska.

Lawlor, J. 1999. Field Environmental Generalist/Alyeska Pipeline Service Company, personal communication, October 30, 1999.

Lawson, D.E. 1986. Response of Permafrost Terrain to Disturbance: A Synthesis of Observations from Northern Alaska, USA. *Arctic and Alpine Research,* 18:1-17.

Lawson, D.E., J. Brown, K.R. Everett, A.W. Johnson, V. Komarkova, B.M. Murray, D.F. Murray, and P.J. Webber. 1978. Tundra Disturbances and Recovery Following the 1949 Exploratory Drilling, Fish Creek, Alaska. CRREL Report 78-28. U.S. Army Cold Regions Research Engineering Laboratory, Hanover, New Hampshire.

Lawson, J.W. and M.T. Williams. 1999. Helicopter Survey of Seal Breathing Holes. Chapter 4 *in:* W.J. Richardson and M.T. Williams (eds.). Monitoring Ringed Seals During Construction of Ice Roads for BP's Northstar Oil Development, Alaskan Beaufort Sea, 1999; 90-day Report. Prepared by LGL Ltd., King City, Ontario and LGL Alaska Research Associates, Inc., Anchorage, Alaska. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska, and National Marine Fish Service, Anchorage, Alaska, and Silver Spring, Maryland.

Leask, L., K. Foster, and L. Gorsuch. 1987. Where Have All the Billions Gone? *Alaska Review of Social and Economic Conditions,* 24:I. February.

Lenart, E.A. 2000. Central Arctic Caribou Field Work Summary for 2000. Alaska Department of Fish and Game, Fairbanks, Alaska. Unpublished report.

LeResch, R.E., R.H. Bishop, and J.W. Coady. 1974. Distribution and Habitats of Moose in Alaska. *Naturaliste Canadien,* 101:143-178.

Lewis, C.E. 1978. The Subsistence Lifestyle in Alaska. The School of Agriculture and Land Resources Management Seminar Series, Special Publication 1. University of Alaska, Fairbanks.

LGL. 1974. Disturbance to Birds by Gas Compressor Noise Simulators, Aircraft, and Human Activity in the Mackenzie Valley on the North Slope, 1972. Arctic Gas Biological Report Series No. 14.

LGL. 1990. Recruitment and Population Studies, Analysis of 1988 Fyke Net Data. The 1988 Endicott Development

Fish Monitoring Program, Volume II. Prepared for BP Exploration (Alaska) Inc. and the North Slope Borough.

LGL. 1991. Analysis of Fyke Net Data. The 1989 Endicott Development Fish Monitoring Program, Volume II. Prepared for BP Exploration (Alaska) Inc. and the North Slope Borough.

LGL. 1992. Analysis of Fyke Net Data. The 1990 Endicott Development Fish Monitoring Program, Volume II. Prepared for BP Exploration (Alaska) Inc. and the North Slope Borough.

LGL. 1993. Analysis of Fyke Net Data. The 1991 Endicott Development Fish Monitoring Program, volume III. Prepared for BP Exploration (Alaska) Inc. and the North Slope Borough.

LGL. 1994a. Analysis of Fyke Net Data. The 1992 Endicott Development Fish Monitoring Program, volume I. Report for BP Exploration (Alaska) Inc. and the North Slope Borough.

LGL. 1994b. Fish and Hydrography Data Report. The 1993 Endicott Development Fish Monitoring Program, Volume I. Prepared by LGL Alaska Research Associates, Inc. Prepared for BP Exploration (Alaska) Inc. and the North Slope Borough.

LGL. 1996. The 1995 Endicott Development Fish Monitoring Program. Vol. I: Fish and Hydrography Data Report. Anchorage, Alaska. Prepared for BP Exploration (Alaska) Inc. and North Slope Borough.

Lieb, J.W. 1989. Game Management Units 13 and 14B, Nelchina Herd. Pages 72-91 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities, 1 July 1987-30 June 1988. Caribou. Federal Aid in Wildlife Restoration Progress Report, Project W-23-1, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Lindsey, K.D. 1986. Paleontological Inventory and Assessment of Public Lands Administered by Bureau of Land Management, State of Alaska. Pages 121-187. Bureau of Land Management, Anchorage, Alaska.

Link, M.R., T.L. Olson, and M.T. Williams. 1999. Ringed Seal Distribution and Abundance Near Potential Oil Development Sites in the Central Alaskan Beaufort Sea, Spring 1998. Prepared by LGL Alaska Research Associates Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Lipkin, R. and D.F. Murray. 1997. Alaska Rare Plant Field Guide. U.S. Department of the Interior, Washington, D.C.

Little, J. 1999.Cook Inlet Risk Debated. *Anchorage Daily News.* September 11, 1999.

Lively, R.A. 1988. Chugwater (FAI–035): A Study of the Effectiveness of a Small Scale Probabilistic Sampling Design at an Interior Alaskan Site. U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Ljungblad, D.K., S.E. Moore, J.T. Clarke, and J.C. Bennett. 1988. Distribution, Abundance, Behavior, and Bioacoustics of Endangered Whales in the Western Beaufort and Mortheastern Chukchi Seas, 1979-87. Final Report MMS-87-0122. U.S. Department of the Interior, Minerals Management Service, Anchorage, Alaska.

Lobdell, J.E. 1981. The Putuligayuk River Delta Overlook Site: Fragile Traces of Ancient Man at Prudhoe Bay, Beaufort Sea, Alaska. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Lobdell, J.E. 1986. The Kuparuk Pingo Site: A Northern Archaic Hunting Camp of the Arctic Coastal Plain, North Alaska. *Arctic,* 39(1):47–51.

Loescher, R. 1999. Native Subsistence Rights—Where Do We Stand Now in State and National Politics? Vol. 1999. Sealaska Corporation.

Logsdon, C.E. 1973. The Alaska Plant Materials Center – A New Institution. *Agroborealis,* 5(1):17.

Lonner, T.D. 1980. Subsistence As An Economic System in Alaska: Theoretical and Policy Implications. Technical Paper Series. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska.

Loughlin, T.R., A.S. Perlov, and V.A. Vladimirov. 1992. Range-wide Survey and Estimation of Total Number of Steller Sea Lions in 1989. *Marine Mammal Science,* 8:220–239.

Lowry, L.F., K.J. Frost, and K.W. Pitcher. 1994. Observations of Oiling of Harbor Seals in Prince William Sound. Pages 209-225 *in:* T.R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, New York, New York.

Luken, J.O. 1984. Net Ecosystem Production in a Subarctic Peatland. Ph.D. dissertation, Duke University, Durham, North Carolina.

Luken, J.O., and W.D. Billings. 1983. Changes in Bryophyte Production Associated with a Thermokarst Erosion Cycle in a Subarctic Bog. *Lindbergia,* 9:163-168.

MacCallum, B. 1988. Seasonal and Spatial Distribution of Bighorn Sheep at an Open Pit Mining Site in the Alberta Foothills. Proceeding of Biennial Symposium Northern Wild Sheep and Goat Council 6:106-120.

Mackay, J.R. 1970. Disturbances to the Tundra and Forest Tundra Environment. *Canadian Geotechnical Journal,* 7:420-432.

Macks, D.D., D. Morrell, and J. Strub. 1997. Common Environmental Problems Encountered During Construction of Major Gas Transmission Lines. Pages 185-189 *in:* J.R. Williams, J.W. Goodrich-Mahoney, J.R. Wisniewski, and J. Wisniewski (eds.). Proceedings of the Sixth International Symposium on Environmental Concerns in Rights-of-Way Management, 24-26 February, New Orleans, Louisiana.

Magoun, A.J. 1985. Ecology of Wolverines on the North Slope of the Brooks Range, Alaska. Ph.D. dissertation, University of Alaska, Fairbanks.

Magoun, A.J., and P. Valkenburg. 1977. The River Otter (*Lutra canadensis*) on the North Slope of the Brooks Range, Alaska. *Canadian Field-Naturalist,* 91:303-305.

Maher, W.J. 1960. Recent Records of the California Gray

Whale (*Eschrichtires glaucus*) Along the North Coast of Alaska. *Arctic* 13:257-265.

Maier, J.A., S.M. Murphy, R.G. White, and M.D. Smith. 1998. Responses of Caribou to Overflights by Low-altitude Jet Aircraft. *Journal of Wildlife Management*, 62:752-766.

Maitland, R.E. 1986. The Chugwater Site (FAI–035): Moose Creek Bluff, Alaska. Final Report, 1982 and 1983 Seasons. U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Maki, A.W. 1992. Of Measured Risks: The Environmental Impacts of the Prudhoe Bay, Alaska, Oil Field. *Environmental Toxicology and Chemistry*, 11:1691-1707.

Makihara, J.S. 1983. The Effects of Coal Dust on Surface Albedo and Thaw Depth in Northern Alaska. *in:* Final Proceedings, Permafrost: Fourth International Permafrost Conference. National Academy Press, Washington, D.C.

Malins, D.C. (ed.) 1977. Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms. Vol. II. Biological Effects. Academic Press, New York, New York.

Manning, E. 1998. Caribou Deaths Halt Collaring Plan. Pages B1-B2 in *Anchorage Daily News.* November 22, 1998.

Manville, R.H., and S.P. Young. 1965. Distribution of Alaskan Mammals. Circular 211. Bureau of Sport Fisheries and Wildlife, Washington, D.C.

MARAD. 1998a. Annual Report. U.S. Department of Transportation, Maritime Administration, Washington, D.C.

MARAD. 1998b. A Report to Congress on U.S. Maritime Policy, FY 1996–FY 2000. U.S. Department of Transportation, Maritime Administration, Washington, D.C.

MARAD. 1999a. An Assessment of the U.S. Marine Transportation System, A Report to Congress. U.S. Department of Transportation, Maritime Administration, Washington, D.C.

MARAD. 1999b. Merchant Fleets of the World, Oceangoing Self-Propelled Vessels of 1,000 Gross Tons and Above. U.S. Department of Transportation, Maritime Administration, Washington, D.C.

MARAD. 1999c. U.S. Merchant Marine Data Sheet. U.S. Department of Transportation, Maritime Administration, Washington, D.C.

MARAD. 1999d. Vessel Inventory Report as of April 1, 1999. U.S. Department of Transportation, Maritime Administration, Washington, D.C.

March, F. 1996. Determining the Significance of Proposed Actions. Sandia National Laboratories. Albuquerque, New Mexico.

Marine Advisers, Inc. 1969. Tsunami at Jackson Point, Alaska. May, 1969.

Marquette, W.M., and H.W. Braham. 1982. Gray Whale Distribution and Catch by Alaskan Eskimos: a Replacement for the Bowhead Whale? *Arctic* 35(3):386-394

Marshall, D. 1993. Migration and Oil Industry Employment of North Slope Alaska Natives. Technical Report 158. Minerals Management Service, Alaska Region.

Martin, L.R., W.J. Wilson, R.L. Howard, and S.K. Waggoner. 1993. Assessment of Fish Overwintering and Habitat Conditions in the Sagavanirktok River Near Trans-Alaska Pipeline Milepost 47. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska.

Martin, P. 1999. U.S. Fish and Wildlife Service, personal communication, October 30, 1999.

Matkin, C.O., G.M. Ellis, M.E. Dahlheim, and J. Zeh. 1994. Status of Killer Whales in Prince William Sound, 1985-1992. Pages 141-162 *in:* T.R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, Inc., San Diego, California.

Matkin, C.O., D.R. Matkin, G.M. Ellis, E. Saulitis, and D. McSweeney. 1997. Movements of Resident Killer Whales in Southeastern Alaska and Prince William Sound, Alaska. *Marine Mammal Science,* 13:469–475.

Mattson, D.J. 1988. Human Impacts on Bear Habitat Use. *International Conference on Bear Research and Management,* 8:33-56.

Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1992. Yellowstone Grizzly Bear Mortality, Human Habituation, and Whitebark Pine Seed Crops. *Journal of Wildlife Management,* 56:432-442.

Mauer, F. 1999. Wildlife Biologist, U.S. Fish and Wildlife Service, Fairbanks, Alaska, personal communication, November 1, 1999.

McBeath, G.A. 1981. North Slope Borough Government and Policymaking. Man in the Arctic Monograph No. 3, ISER Report Series No. 51. Institute of Social and Economic Research, University of Alaska, Anchorage.

McBeath, G.A., and Morehouse, T.A. 1980. The Dynamics of Alaska Native Self-Government. University Press of America, Lanham, Maryland.

McCart, P., C. Craig, and H. Bain. 1972. Report on Fisheries Investigations in the Sagavanirktok River and Neighboring Drainages. Unpublished Report for Alyeska Pipeline Service Company, Bellevue, Washington.

McCarthy, T.M., and R.J. Seavoy. 1994. Reducing Nonsport Losses Attributable to Food Conditioning: Human and Bear Behavior Modification in an Urban Environment. International Conference on Bear Biology and Research 9:75-84.

McClellan, C. 1981. Intercultural Relations and Cultural Change in the Cordillera. Pages 387–401 *in:* Handbook of North American Indian: Subarctic. Volume 6. Smithsonian Institution, Washington, D.C.

McCourt, K., and L. Horstman. 1974. The Reaction of Barren-ground Caribou to Aircraft. Chapter I *in:* R. Jakimchuk (ed.). The Reaction of Some Mammals to Aircraft and Compressor Station Noise Disturbance. Renewable Resources Consulting Services, Ltd. Biological Report Services, Vol. 23.

McDiarmed, G.W., O.S. Goldsmith, M. Kilorin, S. Sharp, and C. Hild. 1998. Expanding Job Opportunities for Alaska Natives. Prepared by Institute of Social and Economic Research. Prepared for Alaska Federation of Natives.

McDonald, M.G. 1991. Moose Movement and Mortality Associated with the Glenn Highway Expansion, Anchorage, Alaska. *Alces,* 27:208-219.

McDonald, M.G. 1996. Game Management Unit 13, Nelchina Herd. Pages 8-10 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1995 - 30 June 1996. Caribou. Federal Aid in Wildlife Restoration Progress Report, Grant W-24-4, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 1997. Game Management Unit 13, Nelchina Herd. Pages 9-11 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1996-30 June 1997. Caribou. Federal Aid in Wildlife Restoration Progress Report, Grant W-24-5, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 1998a. Southcentral Bison Population Management. Pages 1-2 *in:* M.V. Hicks (ed.). Annual Performance Report of Survey-inventory Activities, 1 July 1997 - 30 June 1998. Bison. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 1998b. Southcentral Alaska Dall Sheep Management. Pages 1-5 *in:* M.V. Hicks (ed.). Annual Performance Report of Survey-inventory Activities. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 1998c. Southcentral Brown Bear Population Management. Pages 4-10 *in:* M.V. Hicks (ed.). Annual Performance Report of Survey-inventory Activities, 1 July 1997 - 30 June 1998. Brown Bear. Federal Aid in Wildlife Restoration Report, Grant W-27-1, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 1998d. Southcentral Black Bear Population Management. Pages 5-9 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities, July 1 1997 – 30 June 1998. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 1998e. Southcentral Wolf Population Management. Pages 5-10 *in:* M.V. Hicks (ed.). Annual Performance Report of Survey-inventory Activities, 1 July 1997 – 30 June 1998. Wolf. Federal Aid in Wildlife Restoration Report, Grant W-27-1, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDonald, M.G. 2000. Southcentral Alaska Caribou Management. Pages 1-12 *in:* M.V. Hicks (ed.) Annual Performance Report of Survey-Inventory Activities, 1 July 1999 – 30 June 2000. Caribou. Federal Aid in Wildlife Restoration Grant W-27-3, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

McDowell Group. 1989. Alaska Seafood Industry Study: A Technical Report. Prepared for Alaska Seafood Industry Study Commission.

McDowell Group. 1993. Alaska Visitor Statistics Program: Alaska Visitor Patterns, Opinions and Planning, Summer, 1993. Prepared for the Alaska Division of Tourism, Juneau, Alaska.

McDowell Group. 1999a. Alaska Visitor Industry Economic Impact Study. Prepared for Alaska Department of Commerce and Economic Development.

McDowell Group. 1999b. Economic Impact of the Petroleum Industry on the Fairbanks North Star Borough.

McDowell Group. 2000. Economic and Social Effects of the Oil Industry in Alaska 1975-1995. OCS Study MMS 99-0041. Prepared for Minerals Management Service, Alaska Outer Continental Shelf Region, Anchorage, Alaska.

McGowan, J.D. 1975. Distribution, Density and Productivity of Goshawks in Interior Alaska. Final Report. Federal Aid in Wildlife Restoration, Projects W-17-3, W-17-4, W-17-5, and W-17-6, Job 10.6 R. Alaska Department Fish and Game, Juneau, Alaska.

McGrattan, K.B., H.R. Baum, W.D. Walton, and J. Trelles. 1997. Smoke Plume Trajectories from In Situ Burning of Crude Oil in Alaska – Field Experiments and Modeling of Complex Terrain. NISTR 5958.

McIlroy, C. 1974. Game Management Unit 20D Moose Survey-inventory Progress Report. Pages 154-160 *in:* D. McKnight (ed.). Annual Report of Survey-inventory Activities. Part II. Moose. Volume IV. Federal Aid in Wildlife Restoration Progress Report, Project W-17-5. Alaska Department of Fish and Game, Juneau, Alaska.

McIlroy, C.W. 1970. Aspects of the Ecology and Hunter Harvest of the Black Bear in Prince William Sound. M.S. thesis, University of Alaska, Fairbanks.

McIntosh, E. 1999. U.S. Fish and Wildlife Service, personal communication, October 30, 1999.

McIntyre, J.W. 1994. Loons in Freshwater Lakes. *Hydrobiologia,* 279/280:393–413.

McKechnie, A.M., and D.N. Gladwin. 1993. National Park Service Aircraft Overflight Study: Aircraft Overflight Effects on Wildlife Resources. Prepared by Harris, Miller, Miller, and Hanson Inc. Prepared for USDOI National Park Service. NPS-DSC Contract No. CX-2000-0-0025, Work Order No. 22.

McKendrick, J.D. 1976. Photo-plots Reveal Arctic Secrets. *Agroborealis,* 8(1):25-29.

McKendrick, J.D. 1986. Final Cleanup at Selected (1975-1981) Wellsites, Sampling and Testing of Waters and Bottom Muds in the Reserve Pits and the recording of Tundra Plant Responses on the National Petroleum Reserve in Alaska (NRPA). III. Recording of Tundra Plant Responses.

US Geological Survey Office of the National Petroleum Reserve in Alaska, Anchorage, Alaska.

McKendrick, J.D. 1987. Plant Succession on Disturbed Sites, North Slope, Alaska, USA. *Arctic and Alpine Research,* 19(4):554-565.

McKendrick, J.D. 1991. Arctic Tundra Rehabilitation – Observations of Progress and Benefits to Alaska. *Agroborealis,* 23(1):29-40.

McKendrick, J.D. 1997. Long Term Recovery in Northern Alaska. Pages 503-518 *in:* R.M.M. Crawford (ed.). Disturbance and Recovery in Arctic Lands: An Ecological Perspective. Kluwer Academic, Dordrecht, The Netherlands.

McKendrick, J.D. 1999a. Arctic Tundra Recovery From Crude Oil After 24 years, Prudhoe Bay. *Agroborealis,* 31(1):28-35.

McKendrick, J.D. 1999b. Wildlife and Vegetation Find Habitat Niches on Oil Field Gravel Pad. *Agroborealis,* 31(1):36-38.

McKendrick, J.D. 2000b. Lazy Mountain Research, Palmer, Alaska, personal communication.

McKendrick, J.D., V. Ott, and G.A. Mitchell. 1978. Effects of Nitrogen and Phosphorus Fertilization on Carbohydrate and Nutrient Levels in *Dupotia fisheri* and *Arctagrostis latifolia*. Pages 509-537 *in:* L.L. Tieszen (ed.). Vegetation and Production Ecology of an Alaskan Arctic Tundra. Springer-Verlag, New York, New York.

McKendrick, J.D., P.C. Scorup, W.E. Fiscus, and G. Turner. 1992. Habitat and Biological Changes Over Time on Disturbances at Oil and Gas Exploration and Production Sites in the Alaska Arctic. Alaska Agricultural and Forestry Experiment Station, University of Alaska Palmer.

McKennan, R.A. 1981. Tanana. *in:* J. Helm (ed.). Handbook of North American Indians, Volume 6, Subarctic. Smithsonian Institution Press, Washington, D.C.

McKnight, D.E., ed. 1973. Caribou, brown and grizzly bear, sheep, muskoxen, marine mammals, bison, goat and black bear. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-17-4, Jobs 3.0, 4.0, 6.0, 7.0, 8.0, 9.0, 12.0, 14.0, 15.0 and 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

McKnight, D.E., ed. 1975. Caribou, marine mammals, mountain goat, wolf and black bear. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-17-6, Jobs 3,0, 8.0, 12.0, 14.0, 17.0 and 22. Alaska Department of Fish and Game, Juneau, Alaska.

McKnight, D.E., ed. 1976. Caribou, brown bear, polar bear and black bear. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-17-7, Jobs 3.0, 4.0, 5.0, 17.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

McLaren, M.A., and J.E. Green. 1985. The Reactions of Muskoxen to Snowmobile Harassment. *Arctic,* 38:188-193.

McLellan, B.N. 1988. Relationships Between Human Industrial Activity and Grizzly Bears. International Conference on Bear Research and Management, 8:57-64.

McLellan, B.N. 1989. Dynamics of a Grizzly Bear Population During a Period of Industrial Resource Extraction. II. Mortality Rates and Causes of Death. *Canadian Journal of Zoology,* 67:1861-1864.

McLellan, B.N., and D.M. Shackleton. 1989. Immediate Reactions of Grizzly Bears to Human Activities. *Wildlife Society Bulletin,* 17:269-274.

McMillen, M.C. 1993. An Approach to Defining Significance under NEPA: A Practitioner's Perspective. National Association of Environmental Professionals, Annual Conference. *NAEP Proceedings* 19:194-202.

McMillan, P.O., and S.V. Cuccarese. 1988. Alaska Over-the-Horizon Backscatter Radar System: Characteristics of Contemporary Subsistence Use Patterns in the Copper River Basin and Upper Tanana Area. University of Alaska, Arctic Environmental Information and Data Center, Anchorage, Alaska.

McNabb, S.L., and M. Galginaitis. 1992. The North Slope Region in Social Indicators of Alaskan Coastal Villages, I. Key Informant Summaries. Volume 1: Schedule A Regions (North Slope, NANA, Calista, Aleutian-Pribilof). Social and Economic Studies Program Technical Report No. 151. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

McNay, M.E. 1989. Game Management Unit 20A Tanana Flats, Central Alaska Range. Pages 212-224 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities, 1 July 1987 – 30 June 1999. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-3 and W-23-4, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

McNay, M.E. 1990. Game Management Units 20A, 20B, 20C, 20F and 25C, Central and Lower Tanana Valley and Middle Yukon River Drainages. Pages 121-136 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities, January 1 1988 – December 31 1988. Brown Bear. Federal Aid in Wildlife Restoration Report, Project W-23-2, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

McNay, M.E. 1993. Game Management Unit 20A, Tanana Flats, Central Alaska Range 1989-1991. Pages 230-243 *in:* S.M. Abbott (ed.). Annual Report of Survey-inventory Activities. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-3 and W-23-4, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

McNeary, S.A. 1978. Local Exploitation of D–2 Lands in the Gulf of Alaska Region. Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska, Fairbanks.

Mead, R.D. 1978. Journeys Down the Line, Building the Trans-Alaska Pipeline. Doubleday & Company, Garden City, New York.

Melchoir, H.R. 1980. Moose-Arctic Slope. Pages 119-122 *in:* R. A. Hinman (ed.). Annual Report of Survey-inventory Activities. Part II. Deer, Elk and Moose. Federal Aid in Wildlife Restoration Progress Report, Project W-17-12, Job Numbers 2.0, 13.0, 1.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Merrick, R.L., L.M. Ferm, R.D. Everitt, R. Ream, and L.A. Lessard. 1991. Aerial and Ship-based Surveys of Northern Sea Lions (*Eumetopias jubatus*) in the Gulf of Alaska and Aleutian Islands During June and July 1990. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Technical Memorandum NMFS F/NWC-196.

Meyers, C.R. 1985. Vegetation of the Beaufort Sea Coast, Alaska: Community Composition, Distribution and Tidal Influences. M.S. thesis, University of Alaska, Fairbanks.

Michaelson, J., S. Wilbor, J. Fadely, J. Sherburne, J. Tande, F.R. Norman, and D.C. Duffy. 1999. Recent Distributional Records of Short-tailed Albatross as a Tool for Long-line Fisheries Management. Unpublished abstract of talk at Twenty-sixth Annual Meeting of the Pacific Seabird Group, Blaine, Washington.

Mikkelsen, D. 1997. Unpublished internal memorandum to Joe Riordan, Alyeska Pipeline Service Company, Anchorage, Alaska. June 23, 1997.

Milke, G. 1977. Animal Feeding: Problems and Solutions. Special Report No. 14. Joint State/Federal Fish and Wildlife Advisory Team, Anchorage, Alaska.

Miller, G.W., R.E. Elliott, and W.J. Richardson. 1996. Marine Mammal Distribution, Numbers, and Movements. *In:* Northstar Marine Mammal Monitoring Program, 1995: Baseline Surveys and Retrospective Analyses of Marine Mammal and Ambient Noise Data from the Central Alaskan Beaufort Sea. LGL Report TA 2101-2. LGL Ecological Research Associates, Inc., King City, Ontario, Canada.

Miller, F.L. 1984. Some Physical Characteristics of Caribou Spring Migration Crossing Sites on the Dempster Highway, Yukon Territory. Pages 15-21 *in*: A. Martell and D. Russell (ed.). First North American Caribou Workshop, Whitehorse, Yukon Territory, Canada. September 1983.

Miller, F.L., and A. Gunn. 1979. Responses of Peary Caribou and Muskoxen to Helicopter Harassment, Prince of Wales Island, Northwest Territories. July-August 1976. Canadian Wildlife Service Progress Notes, No. 79.

Miller, F.L., and A. Gunn. 1984. Muskox Defense Formations in Response to Helicopters in the Canadian High Arctic. Biological Papers of the University of Alaska, Special Report No. 4:123-126.

Miller, S.D. 1987. Big Game Studies, Vol. VI. Final 1986 Report for the Susitna Hydroelectric Project. Alaska Department of Fish and Game, Juneau, Alaska.

Miller, S.D. 1988. Impacts of Increased Hunting Pressure on the Density, Structure, and Dynamics of Brown Bear Populations in Alaska's Management Unit 13. Federal Aid in Wildlife Restoration Progress Report, Project W-22-6, Job IVG-4.21. Alaska Department of Fish and Game, Juneau, Alaska.

Miller, S.D. 1993. Impacts of Increased Hunting Pressure on the Density, Structure and Dynamics of Brown Bear Populations in Alaska's Game Management Unit 13. Federal Aid in Wildlife Restoration Final Report, Project W-23-5, Study 4.21. Alaska Department of Fish and Game, Juneau, Alaska.

Miller, S.D. 1997. Impacts of Heavy Hunting Pressure on the Density and Demographics of Brown Bear Populations in Southcentral Alaska. Federal Aid in Wildlife Restoration Final Report, Grants W-24-2 through W-24-6, Study 4.26. Alaska Department of Fish and Game, Juneau, Alaska.

Miller, S.D., and W.B. Ballard. 1982. Density and Biomass Estimates for an Interior Alaskan Brown Bear, *Ursus arctos*, Population. *Canadian Field-Naturalist,* 96:448-454.

Miller, S.D., and W.B. Ballard. 1992. Analysis of an Effort to Increase Moose Calf Survivorship by Increased Hunting of Brown Bears in Southcentral Alaska. *Wildlife Society Bulletin,* 20:445-454.

Miller, S.D., and M.A. Chihuly. 1987. Characteristics of Nonsport Brown Bear Deaths in Alaska. International Conference on Bear Research and Management 7:51-58.

Miller, S.D., and D.C. McAllister. 1981. Alaska Power Authority, Susitna Hydroelectric Project, Environmental Studies Annual Progress Report, Subtask 7.11, Big Game. Alaska Department of Fish and Game, Anchorage, Alaska.

Miller, S.D. and V.L. Tutterow. 1997. Characteristics of nonsport mortalities to brown and black bears and human injuries from bears in Alaska, 1986-1996. ADF&G Fed. Aid in Wildl. Rest. Proj. W-24-4, Study 4.26. Anchorage, Alaska.

Miller, S.D., E. Becker, and W.B. Ballard. 1987. Black and Brown Bear Density Estimates Using Modified Capture/Recapture Techniques in Alaska. International Conference of Bear Research and Management 7:23-35.

Mills, R.O. 1998. Historical Archaeology of Alaskan Placer Gold Mining Settlements: Evaluating Process-Pattern Relationships.. Ph.D. dissertation, University of Alaska, Fairbanks.

Mishler, C.W. 1986. Born With the River: An Ethnographic History of Alaska's Goodpaster and Big Delta Indians. Public Data File 86–14. Alaska Department of Natural Resources, Division of Geological and Geophysical Survey Reports.

Mitchell, W.W. 1970a. Scientific Tour of the Pipeline Route. *Agroborealis,* 2(1):4-5, 22.

Mitchell, W.W. 1970b. Vegetation Problems and Progress. *Agroborealis,* 2(1):18-19.

Mitchell, W.W. 1971. Ecology, Environment and Agriculture. *Agroborealis,* 3(1):4-5,25.

Mitchell, W.W. 1973. Using Native Plant Resources for Conservation. *Agroborealis,* 5(1):24-25.

Mitchell, W.W. 1974. Native Bluejoint: A Valuable Forage and Germplasm Resource. *Agroborealis*, 6(1):21-22.

Mitchell, W.W. 1976. Native Grass Seed Enters Commercial Production. *Agroborealis*, 8(1):19-21.

Mitchell, W.W. 1977. Report and Recommendations on Franklin Bluffs Oil Spill. Letter to Frank R. Fisher, Manager, Environmental Protection, Alyeska Pipeline Service Company, Anchorage, Alaska.

Mitchell, W.W. 1978. Development of Plant Materials for Revegetation in Alaska. *in*: S.T. Kenny (ed.). Proceedings: High Altitude Revegetation Workshop 3. Colorado Water Resources Research Institute Information Series 28. Environmental Resources Center, Colorado State University, Ft. Collins, Colorado.

Mitchell, W.W. 1979. Three Varieties of Native Grasses for Revegetation Purposes. Circular 32. Agricultural Experiment Station, University of Alaska.

Mitchell, W.W. 1981. Alaskan-developed Grass Varieties Coming into Use. *Agroborealis*, 13:56-58.

Mitchell, W.W. 1982. Grasses and Their Uses in Alaska. *Agroborealis,* 14:34-37.

Mitchell, W.W. 1986. Notice of Release of Nortran' Tufted Hairgrass. *Agroborealis*, 18(1):6-7.

Mitchell, W.W. 1988. Registration of Nortran' Tufted Hairgrass. *Crop Science,* 28:1002.

Mitchell, W.W., and L. Allen. 1973. Rotary Plow Gives Yeoman Service. *Agroborealis*, 5(1):26.

Mitchell, W.W., and J.D. McKendrick. 1974. Tundra Rehabilitation Research: Prudhoe Bay and Palmer Research Center. 1973 Progress report prepared by Institute of Agricultural Sciences, University of Alaska, Fairbanks. Prepared for Alyeska Pipeline Service Company, ARCO, Canadian Arctic Gas, Ltd., Exxon, Shell Oil, and Union Oil.

Mitchell, W.W., and J.D. McKendrick. 1975. Report of Research Progress on Reclamation of Land Damaged by Oil Spills. Prepared by University of Alaska Institute of Agricultural Sciences, Palmer Research Center, Palmer, Alaska. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska.

Mitchell, W.W., L. Allen, and C.I. Branton. 1972. A New Tool for Land Preparation in Alaska. *Agroborealis,* 4(1):13-14.

Mitchell, W.W., J.D. Mckendrick, F.J. Wooding, and M.A. Barzee. 1974. Agronomists on the Banks of the Saganavirktok. *Agroborealis,* 6(1):33-35.

MMS. 1979. Alaska Outer Continental Shelf Beaufort Sea Final EIS, Federal/State Oil and Gas Lease Sale. 3 Vols. Minerals Management Service.

MMS. 1982. Alaska Outer Continental Shelf Diapir Field Final EIS, Proposed Oil and Gas Lease Sale 71. Minerals Management Service.

MMS. 1984. Alaska Outer Continental Shelf Diapir Field Lease Offering (June 1984) Final EIS. 2 Vols. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

MMS. 1987a. Alaska Outer Continental Shelf Beaufort Sea Sale 97 Final EIS. OCS/EIS, MMS 87-0069. 2 Vols. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

MMS. 1987b. Alaska Outer Continental Shelf Chukchi Sea Oil & Gas Lease Sale 109 Final EIS. 2 Vols. OCS EIS/EA MMS 87–0110. Minerals Management Service.

MMS. 1990. Alaska Outer Continental Shelf Beaufort Sea Planning Area Oil and Gas Lease Sale 124 Final EIS. OCS EIS/EA MMS 90–063. Minerals Management Service.

MMS. 1991. Chukchi Sea Oil and Gas Lease Sale 126 Final EIS. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

MMS. 1993a. Mineral Revenues, 1993. Minerals Management Service.

MMS. 1993b. Social Indicators Study of Alaskan Coastal Villages, Volume IV. Postspill Key Informant Summaries. Schedule C Communities, Valdez, Cordova, and Tatitlek, Part 1. Minerals Management Service, Human Relations Area Files.

MMS. 1996a. Beaufort Sea Planning Area Oil and Gas Lease Sale 144 Final EIS. OCS EIS, MMS 96-0012. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

MMS. 1997a. Arctic Seismic Synthesis and Mitigating Measures Workshop/Proceedings. OCS Study MMS 97-0014. U.S. Minerals Management Service, Anchorage, Alaska.

MMS. 1997b. Mineral Revenues 1997. Minerals Management Service.

MMS. 1998. Beaufort Sea Planning Area Oil and Gas Lease Sale 170 Final EIS. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

Mobley, C.M. 1991. The Campus Site. University of Alaska Press, Fairbanks, Alaska.

Monson, D.H., D.F. Doak, B.E. Ballachey, A. Johnson, and J.L. Bodkin. 2000. Long-term Impacts of the *Exxon Valdez* Oil Spill on Sea Otters, Assessed through Age-dependent Mortality Patterns. *Proceedings of the National Academy of Sciences*. 97:6562-6567.

Montgomery, K. 1999. OASIS Environmental Inc. (formerly with Alyeska), personal communication, October 30, 1999.

Moore, S.E., and R.R. Reeves. 1993. Distribution and Movement. Pages 313-386 *in:* J.J. Burns, J.J. Montague, and C.J. Cowles (eds.). The Bowhead Whale. Special Publication Number 2, The Society for Marine Mammalogy.

Morehouse, T.A., and L. Leask. 1978. Governance in the Beaufort Sea Region: Petroleum Development and the North

Slope Borough. Alaska OCS Socioeconomics Program, TR16. Bureau of Land Management, OCS Office, Anchorage, Alaska.

Morehouse, T.A., G.A. McBeath, and L. Leask. 1984. Alaska's Urban and Rural Governments. University Press of America, Lanham, Maryland.

Morgan, S.O., ed. 1988. Caribou. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-22-6, Job 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Morgan, S.O., ed. 1990. Caribou. Annual Performance Report of Survey-Inventory Activities. 1 July 1988-30 June 1989. Federal Aid in Wildlife Restoration, Project W-23-2, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Morgantini, L.E. 1985. Ungulate Encounters with Construction Materials (Pipe, Berms, etc.) During the Building of an Underground Gas Pipeline in Western Alberta, Canada. *Alces,* 21:215-230.

Morgantini, L.E., and E. Bruns. 1988. Attraction of Bighorn Sheep to Wellsites and Other Man-made Mineral Licks Along the Eastern Slopes of Alberta: A Management Concern. Proceedings Biennial Symposium Northern Wild Sheep and Goat Council 6:135-140.

Morgantini, L.E., and B.W. Worbets. 1988. Bighorn Sheep Use of a Gas Wellsite During Servicing and Testing: A Case Study of Impact and Mitigation. Proceedings Biennial Symposium Northern Wild Sheep and Goat Council 6:159-164.

Morris, B.F., M.S. Alton, and W.H. Braham. 1983. Living Marine Resources of the Gulf of Alaska. National Marine Fisheries Service, Anchorage, Alaska.

Morrow, J.E. 1980. The Freshwater Fishes of Alaska. Alaska Northwest Publishing Company, Anchorage, Alaska.

Morsell, J.W., J.E. Hemming, G.S. Harrison, D.C. Lees, W.W. Wade, D.F. Jones, and C.B. Fahl. 1979. Environmental Assessment of City of Valdez Port Expansion Project. Dames and Moore, Anchorage, Alaska.

Morstad, S., D. Sharp, J. Wilcock, T. Joyce, and J. Johnson. 1999. Prince William Sound Management Area 1998 Annual Finfish Management Report. Regional Information Report 2A99-20. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Anchorage, Alaska.

Moseby, J. 1999. Bureau of Land Management, personal communication, November 18, 1999.

Mould, E. 1979. Seasonal Movement Related to Habitat of Moose Along the Colville River, Alaska. *The Murrelet,* 60:6-11.

Moulton, L.L. 1989. Recruitment of Arctic Cisco (*Coregonus autumnalis*) into the Colville Delta, Alaska, 1985. Biological Papers of the University of Alaska 24:107–111.

Moulton, L.L. 1994. The 1993 Endicott Development Fish Monitoring Program. Vol. II: The 1993 Colville River Fishery. Unpublished report prepared by MJM Research. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, L.L. 1995. The 1994 Endicott Development Fish Monitoring Program. Vol. II: The 1994 Colville River Fishery. Unpublished report prepared by MJM Research. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, L.L. 1997. The 1996 Endicott Development Fish Monitoring Program. Vol. II: The 1996 Colville River Fishery. Unpublished report prepared by MJM Research. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, L.L., and L.J. Field. 1988. Assessment of the Colville River Fall Fishery 1985-1987. Unpublished report prepared by Environmental Sciences and Engineering Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Moulton, L.L., and L.J. Field. 1991. The 1989 Colville River Fishery. The 1989 Endicott Development Fish Monitoring Program (Vol. III). Unpublished report prepared by MJM Research. Prepared by BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, L.L., and L.J. Field. 1994. The 1992 Colville River Fishery. The 1992 Endicott Development Fish Monitoring Program (Vol. II). Unpublished report prepared by MJM Research. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, L.L., and J.C. George. 2000. Freshwater Fishes in the Arctic Oil-field Region and Coastal Plain of Alaska. Pages 327-348 *in:* J.C. Truett. and S.R. Johnson (eds.). The Natural History of an Arctic Oilfield. Academic Press, San Diego, California.

Moulton, L.L., B.J. Gallaway, M.H. Fawcett, W.B. Griffiths, K.R. Critchlow, R.G. Fechhelm, D.R. Schmidt, and J.S. Baker. 1986. 1984 Central Beaufort Sea Fish Study. Chapter 3. Prudhoe Bay Waterflood Project Environmental Monitoring Program 1984. Prepared by Woodward-Clyde Consultants, Entrix and LGL Ecological Research Associates. Prepared for US Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Moulton, L.L., L.C. Lestelle, and L.J. Field. 1992. The 1991 Colville River Fishery. The 1991 Endicott Development Fish Monitoring Program (Vol. III). Unpublished report prepared by MJM Research. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, L.L., L.C. Lestelle, and L.J. Field. 1993. The 1991 Colville River Fishery. The 1991 Endicott Development Fish Monitoring Program (Vol. III). Unpublished report prepared by MJM Research. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Moulton, V.D., and R.E. Elliot. 1999. Fixed Wing Aerial Surveys of Seals Near BP's Northstar and Liberty Sites, 1999. Chapter 3 *in:* W.J. Richardson and M.T. Williams (eds.). Monitoring Ringed Seals During Construction of Ice

Roads for BP's Northstar Oil Development, Alaskan Beaufort Sea, 1999; 90-day Report. Prepared by LGL Ltd., King City, Ontario, and LGL Alaska Research Associates, Inc., Anchorage, Alaska. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska, and National Marine Fisheries Service, Anchorage, Alaska, and Silver Spring, Maryland.

Mowat, G., K. Poole, and M. O'Donoghue. 1999. Ecology of Lynx in Northern Canada and Alaska. Chapter 9 *in:* The Scientific Basis for Lynx Conservation. General Technical Report RMRS-GTR-30. US Forest Service.

Muench, R.D., and D.L. Nebert. 1973. Physical Oceanography. Pages 103-149 *in:* D.W. Hood, W.E. Shields, and E.J. Kelley (eds.). Environmental Studies of Port Valdez. Institute of Marine Sciences, University of Alaska, Fairbanks.

Muhlbauer, W.K. 1996. Pipeline Risk Management Manual. Second Edition. Gulf Publishing Co.

Mull, C.G., and Adams, K.E. 1989. Bedrock Geology of the Eastern Koyukuk Basin, Central Brooks Range, and Eastcentral Arctic Slope, Dalton Highway, Yukon River to Prudhoe Bay Alaska. State of Alaska Division of Geological and Geophysical Surveys.

Mumford, R. 1999. State of Alaska, Fish and Wildlife Protection, personal communication, November 9, 1999.

Municipality of Anchorage. 1991. Anchorage Indicators, A Sociological Review. Municipality of Anchorage, Department of Economic Development and Planning, Anchorage, Alaska.

Municipality of Anchorage. 1997. Anchorage Indicators. Municipality of Anchorage, Community Planning and Development Department, Anchorage, Alaska.

Murdoch, J. 1892. Ethnological Results of the Point Barrow Expedition. *in:* Ninth Annual Report of the Bureau of American Ethnology for the Years 1887–1888. Washington, D.C. Reprinted by Smithsonian Institution Press, Washington, D.C.

Murphy, S.M., and B.A. Anderson. 1993. Lisburne Terrestrial Monitoring Program: The Effects of the Lisburne Development Project on Geese and Swans, 1985–1989. Unpublished report prepared by Alaska Biological Research, Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Murphy, S.M., and J.A. Curatolo. 1987. Activity Budgets and Movement Rates of Caribou Encountering Pipelines, Roads, and Traffic in Northern Alaska. *Canadian Journal of Zoology,* 65:2483-2490.

Murphy, S.M., and B.E. Lawhead. 2000. Caribou. Pages 59-84 *in:* J.C. Truett and S.R. Johnson (eds.). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Murphy, S.M., B.A. Anderson, C.L. Cranor, and R.H. Day. 1987. Lisburne Terrestrial Monitoring Program 1986: The Effects of the Lisburne Development Project on Geese and Swans. Prepared by Alaska Biological Research, Fairbanks, Alaska. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Murphy, S.M., R.G. White, B.A. Kugler, J.A. Kitchens, M.D. Smith, and D.S. Barger. 1993. Behavioral Effects of Jet Aircraft on Caribou in Alaska. Report for Proceedings of the 6th International Congress of Noise as a Public Health Problem. Vol. 3. INRETS, Arcueilcedex, France.

Murray, D.F., and R. Lipkin. 1987. Candidate Threatened and Endangered Plants of Alaska with Comments on Other Rare Plants. University of Alaska Herbarium, University of Alaska Museum, Fairbanks, Alaska.

Myers, J.P., and F.A. Pitelka. 1980. Seasonal Abundance and Habitat Use Patterns of Shorebirds at Two Sites in Northern Alaska. *Wader Study Group Bulletin,* 29:28–30.

Nadler, E. 1994. Tankers Full of Trouble; the Perilous Journey of Alaskan Crude. Grove Press, New York.

Nagel, P. 2000. Alyeska Pipeline Service Company, Anchorage, Alaska, personal communication, November 13, 2000.

Naidu, A.S., and Klein. 1988. Sedimentation Processes. Chapter 4 *in:* Shaw and Hameedi (eds.) Lecture Notes on Coastal and Estuarine Studies, Vol. 24. Environmental Studies in Port Valdez, Alaska, Springer-Verlag, Berlin, Germany.

Naiman, J. 1996. ANILCA Section 810: An Undervalued Protection for Alaskan Villagers' Subsistence. *Fordham Environmental Law Journal,* Vol. VII:211–350.

Nash, R.F. 1990. Wilderness and the American Mind. Yale University Press, New Haven.

Nash, T.H., III. 1973. The Effect of Air Pollution on Other Plants. Page 192-233 *in:* B.W. Ferry, M.S. Braddeley, and D.L. Hawksworth (eds.). Air Pollution and Lichens. University of Toronto Press, Toronto, Ontario, Canada.

Nauman, J.W., and D.R. Kernodle. 1973. Field Water-quality Information Along the Proposed Trans-Alaska Pipeline Corridor September 1970 Through September, 1972. Basic Data Report. US Geological Survey, Water Resources Division.

Naylor, L., and L. Gooding. 1978. Alaska Native Hire on the Trans-Alaska Oil Pipeline Project. Alaska Review of Social and Economic Conditions.

Neakok, W., D. Neakok, W. Bodfish, D. Libbey, E.S. Hall, and the Point Lay Elders. 1985. To Keep the Past Alive: The Point Lay Cultural Resource Site Survey. North Slope Borough, Barrow, Alaska.

Neff, J.M., and W.A. Stubblefield. 1995. Chemical and Toxicological Evaluation of Water Quality Following the *Exxon Valdez* Oil Spill. *In:* P.G. Wells, J.M. Butler, and J.S. Hughes (eds.). Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters, ASTM STP 1219. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Neiland, B. 1978. Rehabilitation of Bare Sites in Interior Alaska. *Agroborealis,* 10(1):21-25.

Nellemann, C., and R.D. Cameron. 1996. Effects of Petroleum Development on Terrain Preferences of Calving Caribou. *Arctic*, 49:23-28.

Nellemann, C., and R.D. Cameron. 1998. Cumulative Impacts of an Evolving Oil-field Complex on the Distribution of Calving Caribou. *Canadian Journal of Zoology,* 76:1425-1430.

Nelson, E.W. 1899. The Eskimo About Bering Strait. Pages 3–518 *in:* Eighteenth Annual Report of the Bureau of American Ethnology 1896–97. Government Printing Office, Washington, D.C. Reprinted by Smithsonian Institution Press, Washington, D.C., 1983.

Nelson, F.E., and S.I. Outcalt. 1982. Anthropogenic Geomorphology in Northern Alaska. *Physical Geography,* 3:17-48.

Nelson, R. 1979. Cultural Values of the Land in Native Livelihood and Dependence: A Study of Land Use Values Through Time. National Petroleum Reserve in Alaska 105(C) Land Use Study Field Study 1. Prepared by North Slope Borough Contract Staff. Bureau of Land Management, NPRA–A Work Group 1, Anchorage, Alaska.

Nelson, R.K. 1969. Hunters of the Northern Ice. University of Chicago Press, Chicago, Illinois.

Nerini, M. 1984. A Review of Gray Whale Feeding Ecology. Pages 423–450 *in:* M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.). The Gray Whale *Eschrichtius robustus*. Academic Press, Orlando, Florida.

Nichols, D.R.. 1956. Permafrost and Groundwater Conditions in the Glennallen Area, Alaska. U.S. Geological Survey Open File Report 56-91.

Niedoroda, A.W., and J.M. Colonell. 1990. Beaufort Sea Causeways and Coastal Ocean Dynamics. Pages 203-218 *in:* Nineteenth Proceedings of the Eighth Off. Mechanical Engineering Conference. American Society of Mechanical Engineers, New York, New York.

Nixon, J.F. 1991. Effect of Climate Warming on Pipe Creep in Permafrost. *Journal of Cold Region Engineering*, 4(1):67-73.

NMFS. 1992. Recovery Plan for Steller Sea Lions, *Eumetopias jubatus*. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.

NMFS. 2000. Draft Environmental Impact Statement — Federal Actions Associated with Management and Recovery of Cook Inlet Beluga Whales. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Region, Juneau, Alaska. 99 pp. October 2000.

NOAA. 1999a. Endangered and Threatened Species: Threatened Status of Three Chinook Salmon Evolutionarily Significant Units in Washington and Oregon, and Endangered Status of One Chinook Salmon ESU in Washington. National Oceanographic and Atmospheric Administration, Final Rule Federal Register, 64(56):14308-14328. March 24, 1999.

NOAA. 1999b. Listing Endangered and Threatened Species and Designating Critical Habitat: Petition to List Eighteen Species of Marine Fishes in Puget Sound, Washington. National Oceanographic and Atmospheric Administration, Federal Register, 64(118):33037-33040. June 21, 1999.

Nobmann, E.D. 1997. Nutritional Benefits of Subsistence Foods. University of Alaska, Institute of Social and Economic Research, Anchorage, Alaska.

Noel, L.E., and D.W. Funk. 1999. Milne Point F-pad Saline Vegetation Study. Prepared for BP Exploration (Alaska), Inc., Anchorage, Alaska.

Noel, L.E., C.T. Schick, and S.R. Johnson. 1996. Quantification of Habitat Alterations and Bird Use of Impoundments in the Prudhoe Bay Oil Field, Alaska, 1994. Report prepared by LGL Alaska Research Associates, Inc., for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Noel, L.E., and T.L. Olson. 1999a. Caribou Distribution in the Milne Point Unit Study Area, Summer 1998 – Final Report. Prepared by LGL Alaska Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Noel, L.E., and T.L. Olson. 1999b. Bullen Point to Staines River Large Mammal Distribution, Summer 1998 – Final Report. Prepared by LGL Alaska Research Associates. Prepared for BP Exploration (Alaska), Inc., Anchorage, Alaska.

Noel, L.E., R.H. Pollard, W.B. Ballard, and M.A. Cronin. 1998. Activity and Use of Active Gravel Pads and Tundra by Caribou, *Rangifer tarandus granti*, Within the Prudhoe Bay Oil Field, Alaska. *Canadian Field-Naturalist* 112(3):400-409.

Noerenberg, W.H. 1963. Salmon Forecast Studies on 1963 Runs in Prince William Sound. Information Leaflet 21. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau, Alaska.

Norris, L.A. 1997. Address Environmental Concerns with Real Data. Pages 213-218 *in:* J.R. Williams, J.W. Goodrich-Mahoney, J.R. Wisniewski, and J. Wisniewski (eds.). Proceedings of the Sixth International Symposium on Environmental Concerns in Rights-of-Way Management, 24-26 February, New Orleans, Louisiana.

North Pacific Rim. 1981. Chugach Region Community Subsistence Profiles. Anchorage, Alaska.

Northwest Alaskan Pipeline Company. 1980. Socioeconomic Community Profiles: A Background for Planning. Northwestern Alaska Pipeline Company.

Norton, D., J. Roddick, and C. Cain. 1991. Demonstration of Low Head Air Stripper for Petroleum Waste Treatment. Water Pollution Control Federation 64th Annual Conference. October 1991.

Norton, J.D., W. Tonkins, and B. Flanders. 1998. Alyeska Remedies TAPS' Pipeline Vibrations at Thompson Pass. Page 58 *in: Oil and Gas Journal*: June 1998

Nowlin, R.A. 1989. Moose-Arctic Slope. Pages 361-373 *in:*

S.O. Morgan (ed.). Annual Report of Survey-inventory Activities, 1 July 1987 – 30 June 1988. Moose. Federal Aid in Wildlife Restoration Progress Report, Project W-23-1, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1993a. Unit 6 Deer Survey-inventory Progress Report. Pages 62-77 *in:* S.M. Abbott (ed.). Annual Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Progress Report, Project W-23-4 and W-23-5, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1993b. Game Management Unit 6, Prince William Sound. Pages 54-66 *in:* S.A. Abbott (ed.). Management Report of Survey-inventory Activities. Black Bear. Federal Aid in Wildlife Restoration Report, Projects W-23-4 and W-23-5, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1994. Game Management Unit 6, Prince William Sound and North Gulf Coast. Pages 45-64 *In* M. V. Hicks, (ed.). Management Report of Survey-inventory Activities, 1July 1993 - 30 June 1995. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-1 and W-24-2, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1995a. Game Management Unit 6, Prince William Sound. Pages 59-74 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities. Deer. Federal Aid in Wildlife Restoration Report, Grant W-24-3, Study 2.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1995b. Game Management Unit 6, Prince William Sound and North Gulf Coast. Pages 35-57 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Brown Bear. Federal Aid in Wildlife Restoration Report, Grants W-24-1 and W-24-2, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1996a. Game Management Unit 6, Prince William Sound and North Gulf Coast. Pages 50-80 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1July 1993 - 30 June 1995. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2 and W-24-3, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1996b. Game Management Unit 6, Prince William Sound and North Gulf Coast. Pages 65-81 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Black Bear. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1 through W-24-3, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1997. Game Management Unit 6, Prince William Sound and North Gulf Coast. Pages 30-34 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1993 – 30 June 1996. Wolf. Federal Aid in Wildlife Restoration Report, Grants W-24-2 through W-24-4, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1998a. Interior Caribou Population and Habitat Management. Pages 9-19 *in:* M.V. Hicks (ed.). Annual Performance Report Survey-inventory Activities, 1 July 1997 – 30 June 1998. Caribou. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1998b. Interior Dall Sheep Population Management. Pages 6-14 *in:* M.V. Hicks (ed.). Annual Performance Report of Survey-inventory Activities. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report, Grant W-27-1, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

Nowlin, R.A. 1998c. Interior Grizzly Bear Population and Habitat Management. Pages 11-18 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities, July 1 1997 – 30 June 1998. Brown Bear. Federal Aid in Wildlife Restoration Report, Grant W-27-1, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

NPS. 1992. Final Legislative Environmental Impact Statement, All-Terrain Vehicles for Subsistence Use, Gates of the Arctic National Park and Preserve, Alaska. National Park Service, Alaska Regional Office, Anchorage, Alaska.

NPS. 1997. Annual Data Summary: Denali National Park, National Park Service, Gaseous Air Pollutant Monitoring Network. National Park Service, Air Resource Division D-287.

NRC. 1991. Tanker Spills: Prevention by Design. National Research Council, Committee on Tank Vessel Design, Commission on Engineering and Technical Systems. National Academy Press, Washington, D.C.

NRC. 1998. Double-Hull Tanker Legislation, An Assessment of the Oil Pollution Act of 1990. National Research Council (US), Marine Board Commission on Engineering and Technical Systems. National Academy Press, Washington, D.C.

NSB Contract Staff. 1979. Native Livelihood and Dependence: A Study of Land Use Values Through Time. North Slope Borough Contract Staff. National Petroleum Reserve in Alaska 105(C) Land Use Study Field Study 1. Bureau of Land Management, NPR–A Work Group 1, Anchorage, Alaska.

NSB. 1999. North Slope Borough 1998/99 Economic Profile and Census Report. Benjamin P. Nageak, Mayor. North Slope Borough, Department of Planning and Community Services, Barrow, Alaska.

NTSB. 1990. Marine Accident Report, Grounding of the US Tankship *Exxon Valdez* on Bligh Reef, Prince William Sound, Near Valdez, Alaska, March 24, 1989. National Transportation Safety Board, Bureau of Accident Inves-

tigation. Department of Commerce, National Technical Information Service (NTIS), PB90916405, Washington, D.C.

Nyman, D.J., C.B. Crouse, W.J. Hall, H.A. Levin, and J.A. Maple. 1995. Reassessment of Seismic Design Criteria, Trans-Alaska Pipeline, Rev. 1. Prepared by D.J. Nyman and Associates, Houston, Texas, for Alyeska Pipeline Service Company, Anchorage, Alaska.

O'Connor, R.M. 1984. Population Trends, Age Structure, and Reproductive Characteristics of Female Lynx in Alaska, 1961 through 1973. M.S. thesis, University of Alaska, Fairbanks.

Olliff, T., K. Legg, and B. Kaeding (eds.). 1999. Effects of Winter Recreation on Wildlife of the Greater Yellowstone Area: A Literature Review and Assessment. Report to the Greater Yellowstone Coordinating Committee, Yellowstone National Park, Wyoming.

Olson, T.L., and S.A. MacLean. 1999. Waterfowl Responses to On-the-Ground Flexible Pipeline, The Pete's Wicked Prospect No. 1: Simulated Pipeline Study. Final report prepared by LGL Alaska Research Associates, Inc., for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Olson, T.L., and L.E. Noel. 2000. Caribou Distribution in the Milne Point Unit Study Area, Summer 1999. Report prepared by LGL Alaska Research Associates, Inc., for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Oregon State University. 1999. Regional Economic Information System: 1969–1997. Oregon State University, Information Services, Corvallis, Oregon.

ORNL. Various including 1999. Transportation Energy Data Book. Oak Ridge National Laboratories. Oak Ridge, Tennessee.

Orth, D.J. 1967. Dictionary of Alaska Place Names. Geological Survey Professional Papers 567. Government Printing Office, Washington, D.C.

Orth, D.J. 1971. Dictionary of Alaska Place Names. Geological Survey Professional Papers 567. Government Printing Office, Washington, D.C.

Osborne, T.O. 1989. Game Management Unit 24 Koyukuk River Drainage Above Dulbi River. Pages 334-341 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities, 1 July 1987 – 30 June 1988. Moose. Federal Aid in Wildlife Restoration Progress Report, Project W-23-1, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Osborne, T.O. 1991. Game Management Unit 24, Koyukuk River Drainage. Pages 242-249 *in:* S.M. Abbott (ed.). Management Report of Survey-inventory Activities, July 1 1989 – June 30 1991. Brown Bear. Federal Aid in Wildlife Restoration Report, Projects W-23-3 and W-23-4, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Osborne, T.O. 1993. Game Management Unit 24 Koyukuk River Drainage Above Dulbi River. Pages 375-384 *in:* S.M. Abbott (ed.). Survey-inventory Management Report, 1 July 1989 – 30 June 1991. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-3 and W-23-4, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Osborne, T.O. 1995. Game Management Units 20F, 21C, 21D and 24, Galena Mountain, Ray Mountains, and Wolf Mountain Herds. Pages 146-156 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1992 – 30 June 1994. Caribou Federal Aid in Wildlife Restoration Report, Grants W-24-2 and W-24-3, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Osborne, T.O. 1996. Game Management Unit 24, Brooks Range within GANWR and West of the Dalton Highway. Pages 158-166 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities, 1 July 1992 - 30 June 1995. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report. Grants W-24-1, W-24-2 and W-24-3, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

Osterkamp, T.E., and V.E. Romanovsky. 1999. Evidence for Warming and Thawing of Discontinuous Permafrost in Alaska. *Permafrost and Periglacial Processes,* 10:17-37.

Osterkamp, T.E., D.C. Esch, and V.E. Romanovsky. 1998. Permafrost. Pages 115-127 *in:* G. Weller, and P.A. Anderson (eds.). Implications of Global Change in Alaska and the Bering Sea Region. Center for Global Change and Arctic System Research, University of Alaska.

Oswalt, W. 1967. Alaskan Eskimos. Chandler, San Francisco, California.

Ovenden, L. 1986. Vegetation Colonizing the Bed of a Recently Drained Thermokarst Lake (Illisarvils), Northwest Territories. *Canadian Journal of Botany,* 64:2688-2692.

Oxley, D.J., M.B. Fenton, and G.R. Carmody. 1974. The Effects of Roads on Populations of Small Mammals. *Journal of Applied Ecology,* 11:51-59.

Page, G.W., and R.E. Gill, Jr. 1994. Shorebirds in Western North America: Late 1800s to Late 1900s. Pages 147–160 *in:* J.R. Jehl, Jr., and N.K. Johnson (eds.). A Century of Avifaunal Change in Western North America. Studies in Avian Biology No. 15. Cooper Ornithological Society, Allen Press, Inc., Lawrence, Kansas.

Pamplin, W., Jr. 1979. Construction Related Impacts of the Trans-Alaska Pipeline System on Terrestrial Wildlife Habitats. Special Report 24. Joint State/Federal Fish and Wildlife Advisory Team, Anchorage, Alaska.

Paragi, T.F., W.N. Johnson, D.D. Katnik, and A.J. Magoun. 1996. Marten Selection of Postfire Seres in the Alaskan Taiga. *Canadian Journal of Zoology,* 74:2226-2237.

Parametrix, Inc. 1997. Alpine Development Project Environmental Evaluation Document. Prepared by Parametrix, Inc., Kirkland, Washington. Prepared for US Army Corps of Engineers, Anchorage, Alaska.

Pasitschniak-Arts, M., and S. Larivière. 1995. *Gulo gulo*. Mammalian Species No. 587. American Society of Mammalogists.

Patterson, A. 1974. Subsistence Harvests in Five Native Regions. Joint Federal-State Land Use Planning Commission for Alaska, Anchorage, Alaska.

Peakall, D.B., D. Hallett, D.S. Miller, R.G. Butler, and W.B. Kinter. 1980. Effects of Ingested Crude Oil on Black Guillemots: a Combined Field and Laboratory Study. *Ambio*. 9:28-30.

Perham, C.J. 1995. Home Range, Habitat Selection, and Movements of Lynx (*Lynx canadensis*) in Eastern Interior Alaska. M.S. thesis, University of Alaska, Fairbanks.

Perry, H.R. 1982. Muskrats. Chapter 15 *in:* J.A. Chapman and G.A. Feldhamer (eds.). Wild Mammals of North America. John Hopkins University Press, Baltimore, Maryland.

Petersen, M.R., W.W. Larned, and D.C. Douglas. 1999. At-sea Distribution of Spectacled Eiders: A 120-year-old Mystery Resolved. *Auk,* 116:1009–1020.

Peterson, K.M., and W.D. Billings. 1978. Geomorphic Processes and Vegetational Change Along the Meade River Sand Bluffs in Northern Alaska. *Arctic,* 31:7-23.

Peterson, K.M., and W.D. Billings. 1980. Tundra Vegetational Patterns and Succession in Relation to Microtopography Near Atkasuk, Alaska. *Arctic and Alpine Research,* 12:473-482.

Péwé, T.L. 1975, Quaternary Geology of Alaska. US Geological Survey Professional Paper 835.

Péwé, T.L. 1982. Geologic hazards of the Fairbanks Area, Alaska. Alaska Geological and Geophysical Surveys Special Report 15.

Péwé, T.L., and R.D. Reger (eds.). 1983. Richardson and Glenn Highways, Alaska, Guidebook to Permafrost and Quaternary Hydrology. Alaska Division of Geological and Geophysical Surveys, Fairbanks, Alaska.

Philo, L.M., G.M. Carroll, and D.A. Yokel. 1993. Movements of Caribou in the Teshepuk Lake Herd as Determined by Satellite Tracking, 1990-1993. Joint report by North Slope Borough, Barrow; Alaska Department of Fish and Game, Barrow; and Bureau of Land Management, Fairbanks, Alaska.

Pielou, E.C. 1994. A Naturalist's Guide to the Arctic. The University of Chicago Press, Chicago, Illinois. 327 pp.

Plafker, G., and L.R. Mayo. 1965. Tectonic Deformation, Subaqueous Slides and Destructive Waves Associated with the Alaskan March 27, 1965 Earthquake: An Interim Geologic Evaluation. U.S. Department of the Interior, Geological Survey, open-file report.

Pitcher, K. 1990. Major Decline in Number of Harbor Seals, *Phoca vitulina richardsi*, on Tugidak Island, Gulf of Alaska. *Marine Mammal Science,* 6.2:121-134.

Pitcher, K.W. 1984. Susitna Hydroelectric Project, Phase II, Big Game Studies. Volume IV. Caribou. Alaska Department of Fish and Game Progress Report. Anchorage, Alaska. 41 pp.

Pitcher, K.W. 1989. Harbor Seal Trend Count Surveys in Southern Alaska, 1988. NTIS No. PB90-208628/AS. Marine Mammal Commission, Washington, D.C.

Pitcher, K.W., and D. Calkins. 1979. Biology of the Harbor Seal (*Phoca vitulina richardsi*) in the Gulf of Alaska. OCSEAP Final Report 19(1983):231-310. U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

Pitcher, K.W., and D.G. Calkins. 1981. Reproductive Biology of Steller Sea Lions in the Gulf of Alaska. *Journal of Mammalogy* 62:599-605.

Pitelka, FA. 1974. An avifaunal review for the Barrow region and North Slope of arctic Alaska. *Arctic and Alpine Research* 6:161–184.

Pollard, R.H., W.B. Ballard, M.A. Cronin, and L.E. Noel. 1996a. Summer Distribution of Caribou, *Rangifer tarandus granti*, in the Area of the Prudhoe Bay Oil Field, Alaska, 1990-1994. *Canadian Field-Naturalist,* 110:659-764.

Pollard, R.H., W.B. Ballard, M.A. Cronin, and L.E. Noel. 1996b. Parasitic Insect Abundance and Microclimate of Gravel Pads and Tundra Within the Prudhoe Bay Oil Field, Alaska, in Relation to Use by Caribou, *Rangifer tarandus granti*. *Canadian Field-Naturalist,* 110:649-658.

Pollard, R.H., R. Rodrigues, and R.C. Wilkinson. 1990. Wildlife Use of Disturbed Habitats in Arctic Alaska: 1989 Final Report. Prepared by LGL Alaska Research Associates, Inc., for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Pomeroy, G.W. 2000. Alyeska Pipeline Service Company, Anchorage, Alaska, personal communication, November 13, 2000.

Pomeroy, G.W., and J.D. Norton. 2000. Use of Isolation Stopples for Valve Replacement on Trans-Alaska Pipeline. ETCE/OMAE. Proceedings of the International Pipeline Conference, Calgary, Alberta, Canada.

Porsild, A.E. 1945. Mammals of the MacKenzie Delta. *Canadian Field-Naturalist* 59(1):4-22.

Portman, C.R. 2000. Prudhoe Bay GTL Project on Horizon. *Resources Review.* Resource Development Council, Anchorage, Alaska.

Power, G. 1997. A Review of Fish Ecology in Arctic North America. Pages 13-39 *in:* J. Reynolds, (ed.). Fish Ecology in Arctic North America. American Fisheries Society Symposium 19. American Fisheries Society, Bethesda, Maryland.

Powers, W.R., and J.F. Hoffecker. 1989. Late Pleistocene Settlement in the Nenana Valley, Central Alaska. *American Antiquity* 54(2):263-287.

Preston, T. 1999. Field Environmental Generalist/Alyeska Pipeline Service Company, personal communication, October 30, 1999.

Programmatic Agreement. 1997. Programmatic Agreement on Protection of Historic Properties During Emergency Contingency Plan, Annex M. Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases. Agreement between 10 federal and state agencies. From web site: www.achp.gov/NCP-PA.html.

Pullar, G. 1997. Two Centuries of Changing Identity: The Case of the Tangirnarmiut. American Museum of Natural History, New York, New York.

PWSEDC. 1999. Prince William Sound Economic Development Council web site: www.alaska.net/~pwsedc.

Quakenbush, L., and J. Cochrane. 1993. Report on the Conservation Status of the Steller's Eider (*Polysticta stelleri*), a Candidate Threatened and Endangered Species. Report with recommendations for listing as a threatened species submitted by US Fish and Wildlife Service, Ecological Services, Fairbanks, Alaska, and Anchorage, Alaska. Submitted to US Fish and Wildlife Service, Office of Endangered Species, Washington, D.C.

Quakenbush, L.T., R.S. Suydam, K.M. Fluetsch, and C.L. Donaldson. 1995. Breeding Biology of Steller's Eiders Nesting Near Barrow, Alaska, 1991–1994. Unpublished technical report prepared by US Fish and Wildlife Service, Fairbanks, Alaska, and North Slope Borough, Department of Wildlife Management, Barrow, Alaska. NAES-TR-95-03.

Quimby, R. 1974. Grizzly Bear. Chapter II *in:* R.D. Jakimchuk (ed.). Mammal Studies in Northeastern Alaska with Emphasis within the Canning River Drainage. Renewable Resources Consulting Services Ltd. Canadian Arctic Gas Study, Ltd. Biological Report Series, Vol. 24.

Racine, C.H., and G.M. Ahlstrand. 1991. Thaw Response of Tussock-shrub Tundra to Experimental All-terrain Vehicle Disturbance in South-central Alaska. *Arctic,* 44:31-37.

Racine, C.H., and L.A. Johnson. 1988. Effects of All-terrain Vehicle Traffic on Tundra Terrain Near Anaktuvuk Pass, Alaska. CRREL Spec. Rep. 88-17. US Army Cold Region Research Engineering Laboratory, Hanover, New Hampshire.

Racine, C.H., M.T. Jorgenson, and J.C. Walters. 1998. Thermokarst Vegetation in Lowland Birch Forests on the Tanana Flats, Interior Alaska, USA. Pages 927-933 *in:* A.G. Lewkowicz and M. Allard (eds.). Proceedings of Seventh International Conference on Permafrost. Collection Nordicana 57. Universite Laval, Sainte-Foy, Quebec, Canada.

Rausch, R.L. 1953. On the Status of Some Arctic Mammals. *Arctic,* 6:91-148.

Rausch, R.L. 1958. Some Observations on Rabies in Alaska, with Special Reference to Wild Canidae. *Journal Wildlife Management,* 22:246-260.

Rawlinson, S.E. 1993. Surficial Geology and Morphology of the Alaskan Central Arctic Coastal Plain. Report of Investigations 93-1172. Alaska Division of Geological and Geophysical Surveys, Fairbanks, Alaska.

Ray, P.H. 1885. Narrative in Report of the International Polar Expedition to Point Barrow, Alaska. Report to the House of Representatives, US Congress, Ex. Doc. 44. Washington, D.C.

Raymond, C.W.C. 1871. Report of a Reconnaissance of the Yukon River, Alaska Territory, July to September 1869. 42nd Congress, 1st Session, Senate Executive Document No. 12. Government Printing Office, Washington, D.C.

Raymond, C.P. 1900. Reconnaissance of the Yukon River, 1869. *In:* Compilations of Narratives of Exploration in Alaska. Government Printing Office, Washington, D.C.

Reanier, R.E. 1995. The Antiquity of Paleoindian Materials in Northern Alaska. *Arctic Anthropology* 32(1):31-50.

Reaume, D. 1999. The Contemporary and Future Alaska Economy: Prospects for Economic Development and Diversity. *in:* Clive Thomas (ed.). Alaska Public Policy Issues. Denali Press, Juneau, Alaska.

Reckord, H. 1983. That's the Way We Live: Subsistence Use in the Wrangell-Saint Elias National Park and Preserve. Occasional Paper 34. Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska, Fairbanks.

Reed, C.E. 1985. The Role of Wild Resource Use in Communities of the Central Kenai Peninsula and Kachemak Bay, Alaska. Technical Paper No. 106. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Reed, P.B., Jr. 1988. National List of Plant Species That Occur in Wetlands: Alaska (Region A). Biological Report 88 (26.11) US Fish Wildlife Service.

Reese, N. 2000. Alaska Railroad, personal communication on moose killed by trains in Alaska. March 14, 2000.

Resource Planning Team. 1974. Subsistence Harvests in Five Native Regions. Joint Federal-State Land Use Planning Team for Alaska, Anchorage, Alaska.

Reub, G.S., J.D. Durst, and D.R. Glass. 1991. Fish Distribution and Abundance. Vol. 6, Chap. 1, Part IV. Endicott Environmental Program, Final Reports, 1987. Unpublished report prepared by Envirosphere Company. Available at US Army Corps of Engineers, Anchorage, Alaska.

Reynolds, H.G. 1987. Game Management Units 24-26, Brooks Range. Pages 65-67 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Part V Brown/Grizzly Bear. Federal Aid in Wildlife Restoration Report, Vol. XVIII, Project W-23-1, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.G. 1989. Game Management Units 24, 25, 26B and 26C. Pages 174-184 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Part V Brown/Grizzly Bear. Federal Aid in Wildlife Restoration Report, Vol. XVIX, Project W-23-1, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V. 1981a. Game Management Unit 6 Prince William Sound and North Gulf Coast. Pages 51-52 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities, Part I. Black Bears and Brown Bears. Vol XII. Federal Aid in Wildlife Restoration Report, Projects W-19-1 and W-19-2, Jobs 17.0, 4.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V. 1981b. Game Management Units 24-26 Brooks Range. Pages 94-96 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities, Part I. Black Bears and Brown Bears. Vol XII. Federal Aid in Wildlife Restoration Report, Projects W-19-1 and W-19-2, Jobs 17.0, 4.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V. 1993. Evaluation of the Effects of Harvest on Grizzly Bear Population Dynamics in the Northcentral Alaska Range. Federal Aid in Wildlife Restoration Final Report, Project W-23-5, Study 4.25. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V. 1997. Effects of Harvest on Grizzly Bear Population Dynamics in the Northcentral Alaska Range. Federal Aid in Wildlife Restoration Final Report, Projects W-24-1 through W-24-2, Study 4.25. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V. 1999. Effects of Harvest on Grizzly Bear Population Dynamics in the Northcentral Alaska Range. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-5 and W-27-1, Study 4.28. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V., and J.L. Hechtel. 1986. Population Structure, Reproductive Biology and Movement Patterns of Grizzly Bears in the Northcentral Alaska Range. Federal Aid in Wildlife Restoration Final Report, Projects W-21-1 and W-22-2 through W-22-4, Study 4.25. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, H.V., and J.L. Hechtel. 1992. Effects of Harvest Rates on Grizzly Bear Population Dynamics in the Northcentral Alaska Range. Federal Aid in Wildlife Restoration Final Report, Projects W-22-5, W-22-6, and W-23-1 through W-23-4, Study 4.25. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, J.B. 1997. Ecology of Overwintering Fishes in Alaskan Freshwaters. Pages 281-302 *in:* A.M. Milner and M.W. Oswood (eds.). Freshwaters of Alaska: Ecological Synthesis. Springer-Verlag, New York, New York.

Reynolds, J.R. 1979. History and Current Status of Sitka Black-tailed Deer in Prince William Sound. Pages 177-183 *in:* O.C. Wallmo and J.W. Schoen (eds.). Sitka Black-tailed Deer: Proceedings of a Conference in Juneau, Alaska. US Forest Service, Alaska Region, Juneau, Alaska. Series Number R10-48.

Reynolds, J.R. 1981a. Unit 6 Mountain Goat Survey-inventory Progress Report. Pages 203-211 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities, Part VII. Mountain Goat. Volume XVIII. Federal Aid in Wildlife Restoration Progress Report, Project W-22-6, Job 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, J.R. 1981b. Game Management Unit 6, Prince William Sound and North Gulf Coast. Pages 21-23 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities, Part 1. Black Bears and Brown Bears. Federal Aid in Wildlife Restoration Progress Report, Vol. XII. Projects W-19-1 and W-19-2, Jobs 17.0, 4.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Reynolds, P.E. 1984. Distribution, Movements and Herd Dynamics of Radio-collared Muskoxen in the Arctic National Wildlife Refuge, Alaska. Biological Paper, University of Alaska Special Report No. 4:88.

Reynolds, P.E. 1998. Dynamics and Range Expansion of a Reestablished Muskox Population. *Journal of Wildlife Management*, 62:734-744.

Ricard, J.G., and G.J. Doucet. 1993. Moose (*Alces alces*) Harvest by Recreational Hunting Near Powerline Rights-of-way in Quebec. Pages 323-324 *in:* G.J. Doucet, C. Seguin, and M. Giguere (eds.). Proceedings of the Fifth International Symposium on Environmental Concerns in Rights-of-Way Management, 19-22 September 1993.

Rice, D.W., and A.A. Wolman. 1971. The Life History and Ecology of the Gray Whale (*Eschrichtius robustus*). American Society of Mammalogy Special Publication No. 3.

Rice, S.D., R.B. Spies, D.A. Wolfe, and B.A. Wright (eds.). 1996. Proceedings of the *Exxon Valdez* Oil Spill Symposium. American Fisheries Society Symposium No. 18. American Fisheries Society, Bethesda, Maryland.

Richard, W.E., and F. Deneke. 1972. Preliminary Investigation of Petroleum Spillage, Haines-Fairbanks Military Pipeline, Alaska. CRREL Special Report 170.

Richardson, J. 2000. LGL Ltd, environmental research associates, King City, Ontario. Personal communication.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1986. Reactions of Bowhead Whales, *Balaena mysticetus*, to Seismic Exploration in the Canadian Beaufort Sea. *J. Acoust. Soc. Am.*, 79:1117-1128.

Richardson, W.J., C.R. Greene Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, California.

Richardson, W.J., G.W. Miller, and C. R. Greene, Jr. 1999. Displacement of Migrating Bowhead Whales by Sounds from Seismic Surveys in Shallow Waters of the Beaufort Sea. *J. Acoust. Soc. Am.,* 106:2281.

Rickard, W.E., Jr., and J. Brown. 1974. Effects of Vehicles on Arctic Tundra. *Environmental Conservation*, 1:55-62.

Rieger, S., D.B. Schoephorster, and C.E. Furbush. 1979. Exploratory Soil Survey of Alaska. US Soil Conservation Service.

Ritchie, R.J. 1999. Senior Research Biologist, ABR, Inc., personal communication.

Ritchie, R.J. 1987. Response of Adult Peregrine Falcons to

Experimental and Other Disturbance Along the Trans-Alaska Pipeline System, Sagavanirktok River, Alaska, 1985, 1986. Final report by Alaska Biological Research, Inc., Fairbanks, Alaska. Prepared for Alyeska Pipeline Service, Company, Anchorage, Alaska.

Ritchie, R.J. 1991. Effects of Oil Development on Providing Nesting Opportunities for Gyrfalcons and Rough-legged Hawks in Northern Alaska. *Condor,* 93:180–184.

Ritchie, R.J., and R.E. Ambrose. 1987. Winter Records of Bald Eagles, *Haliaeetus leucocephalus*, in Interior Alaska. *Canadian Field-Naturalist*,101:86-87.

Ritchie, R.J., and S. Ambrose. 1996. Distribution and Population Status of Bald Eagles (*Haliaeetus leucocephalus*) in Interior Alaska. *Arctic,* 49:120-128.

Ritchie, R.J., T.J. Doyle, and J.M. Wright. 1998. Peregrine Falcons (*Falco peregrinus*) Nest in a Quarry and on Highway Cutbanks in Alaska. *J. Reptor Research* 32:261-264.

Ritchie, R.J., and J. Rose. 1999. Results of Raptor Surveys on the Tanana River and in Yukon MOAs 1–2, Alaska, 1998. Final report prepared by ABR, Inc., Fairbanks, Alaska. Prepared for US Fish and Wildlife Service, Fairbanks, Alaska.

Robards, F.C. 1952. Annual Report: Game, Fur and Fish. (Memorandum). US Fish and Wildlife Service, Cordova, Alaska.

Robards, F.C. 1954. Annual Report - Game, Fur and Fish: Cordova, 1953. Unpublished report of the Alaska Game Commission.

Roberson, K. 1986. Range Extension of the Sitka Black-tailed Deer, *Odocoileus hemionus sitkensis*, in Alaska. *Canadian Field Naturalist,* 100(4):563-565.

Roberts, J. 1992. When Kids go to High School, They're Lucky. *in:* R. Strickland (ed.). Alaskans, Life on the Last Frontier. Stackpole Books, Harrisburg, Pennsylvania.

Robinson, S.R. 1988. Status of the Ray Mountains Caribou Herd. Pages 149-160 *in:* R.D. Cameron and J.L. Davis (eds.). Proceedings of the Third North American Caribou Workshop. Technical Bulletin No. 8. Alaska Department of Fish and Game, Fairbanks, Alaska.

Robus, M.A. 1984. Summer Food Habits of Muskoxen in Northeastern Alaska. Biological Papers, University of Alaska Special Report No. 4:81-85.

Roby, D.D. 1978. Behavioral Patterns of Barren-ground Caribou of the Central Arctic Herd Adjacent to the Trans-Alaska Oil Pipeline. M. S. thesis, Univ. Alaska, Fairbanks.

Rockwell, J., Jr. 1978. Criteria for Crossing Small Drainages Containing Fish. Alaska Pipeline Office Narrative Surveillance Report. Attachment G. US Alaska Pipeline Office, Anchorage, Alaska.

Rodahl, K. 1963. The Last Few. Harper & Row, New York, New York.

Roderick, J. 1997. Crude Dreams: A Personal History of Oil and Politics in Alaska. Epicenter Press, Fairbanks, Alaska.

Rodrigues, R. 1992. Bird Use of Abandoned Gravel Pads in Arctic Alaska: 1990 and 1991. Final report prepared by LGL Alaska Research Associates, Inc., Anchorage, Alaska. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Rogers, G. 1999. The Alaska Economy and Economic Issues: An Historical Overview. *in:* Clive Thomas (ed.). *Alaska Public Policy Issues.* The Denali Press, Juneau, Alaska.

Roseneau, D.G., H. Reynolds III, and C.M. White. 1976. Northeastern Alaska. Pages 243–245 *in:* R.W. Fyfe, S.A. Temple, and T.J. Cade (eds.). The 1975 North American Peregrine Falcon Survey. *Canadian Field-Naturalist*, 90:228–273.

Roseneau, D.G., C.E. Tull, and R.W. Nelson. 1981. Protection strategies for peregrine falcons and other raptors along the planned Northwest Alaskan gas pipeline route. Vol. 1. Unpubl. report prepared for Northwest Alaskan Pipeline Co., and Fluor Northwest, Inc., Fairbanks, Alaska, by LGL Alaska Research Associates, Inc., Fairbanks, Alaska.

Rothe, T.C., C.J. Markon, L.L. Hawkins, and P.S. Koehl. 1983. Waterbird Populations and Habitats of the Colville River Delta, Alaska. 1981 Summary Report. US Fish and Wildlife Service, Office of Special Studies, Anchorage, Alaska.

Rotterman, L.M., and T. Simon-Jackson. 1988. Sea Otter, *Enhydra lutris*. Pages 237-275 *in:* J.W. Lentfer (ed.). Selected Marine Mammals of Alaska. Marine Mammal Commission, Washington, D.C.

Rural Impact Program. 1977. The Impact of the Trans-Alaska Oil Pipeline on Rural Communities in Alaska's Interior. Fairbanks Town and Village Association for Development, Inc., Fairbanks, Alaska.

Russell, D.E., and A.M. Martell. 1984. Influence of the Dempster Highway on the Activity of the Porcupine Caribou Herd. Pages 22-26 *in:* A.M. Martell and D.E. Russell (eds.). Proceedings of the First North American Caribou Workshop, September 28-29, 1983, Whitehorse, Yukon Territory, Canada.

Rutz, C., R. Brown, and B. Kellems. 1991. Biological Oxidation of Petroleum Wastewater at Valdez Alaska. Water Pollution Control Federation 64^{th} Annual Conference. October 1991.

Rutz, C. D. Norton, and C.Cain. 1992. Low-Head Air Stripper Treats Oil Tanker Ballast Water. *In: Water Environment & Technology Magazine*, Vol 4, Number 2, February 1992.

S.R. Braund and Associates. 1988. North Slope Subsistence Study — Barrow, 1987. Alaska OCS Sociocultural Studies Program, Technical Report No. 133. Prepared by S.R. Braund and Associates and Institute of Social and Economic Research. Prepared for Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

S.R. Braund and Associates. 1989. North Slope Subsistence Study — Barrow, 1988. Alaska OCS Sociocultural Studies Program, Technical Report No. 135. Prepared by S.R. Braund and Associates and Institute of Social and Economic Research. Prepared for Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

S.R. Braund and Associates. 1993. North Slope Subsistence Study — Barrow, 1987, 1988, and 1989. Alaska OCS Sociocultural Studies Program, Technical Report No. 149. Prepared by S.R. Braund and Associates and Institute of Social and Economic Research. Prepared for Minerals Management Service, Alaska OCS Region, Anchorage, Alaska and the North Slope Borough.

Sage, B.L. 1971. A Study of White-billed Divers in Arctic Alaska. *British Birds* 64519–528.

Sage, B.L. 1974. Ecological Distribution of Birds in the Atigun and Sagavanirktok River Valleys, Arctic Alaska. *Canadian Field-Naturalist,* 88:281-291.

Salisbury, C.A. 1992. Alaska Territorial Guard Cite – Soldiers of the Mists: Minutemen of the Alaska Frontier. Pictorial Histories Publishing Co., Missoula, Montana.

Samuel, D.E., and B.B. Nelson. 1982. Foxes. Chapter 22 *in:* J.A. Chapman and G.A. Feldhamer (eds.) Wild Mammals of North America. John Hopkins University Press, Baltimore, Maryland.

Sauer, J.R., J.E. Hines, I. Thomas, J. Fallon, and G. Gough. 1999. The North American Breeding Bird Survey, Results and Analysis 1966 - 1998. Version 98.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Saulitis, E.L. 1993. The Behavior and Vocalizations of the “AT” Group of Killer Whales (*Orcinus orca*) in Prince William Sound, Alaska. M.S. thesis, University of Alaska, Fairbanks.

Scheffer, V.B. 1949. The Dall porpoise, *Phocoenoides dalli*, in Alaska. *Journal of Mammalogy,* 30:116–121.

Schell, D.M. 1998. Isotope Ratio Evidence of Declining Primary Productivity in the Bering Sea. Pages 65-137 *in:* Testing Conceptual Models of Marine Mammal Trophic Dynamics Using Carbon and Nitrogen Stable Isotope Ratios. Final Report, OCS Study MMS 98-0031. University of Alaska, Fairbanks, Water and Environmental Research Center. Fairbanks, Alaska.

Schempf, P.F. 1989. Raptors in Alaska. Pages 144–154 *in:* Proceedings of the Western Raptor Management Symposium and Workshop, 26–28 October 1987, Boise, Idaho. Scientific and Technical Series No. 12. National Wildlife Federation, Washington, D.C.

Schlickeisen, R.O., C.W. Consolvo, and R.C. Raymond. 1971. Education Systems Resources Incorporated, A Study of the Impact of the Proposed Trans-Alaska Pipeline on the Alaska Native Population. Prepared for Bureau of Indian Affairs.

Schmid, W.D. 1971. Modification of the Subnivean Microclimate by Snowmobiles. Pages 251-255 *in:* A.O. Haugen (ed.). Proceedings of the Snow and Ice in Relation to Wildlife and Recreation Symposium. Iowa Cooperative Wildlife Research Unit, Iowa State University, Ames, Iowa.

Schmidt, D. 1999. Field Environmental Generalist/Alyeska Pipeline Service Company, personal communication, October 30, 1999.

Schmidt, D., W.B. Griffiths, D.K. Beaubien, and C.J. Herlugson. 1991. Movement of Young-of-the-year Arctic Ciscoes Across the Beaufort Sea Coast, 1985-1988. American Fisheries Society Symposium 11:132-144. American Fisheries Society, Bethesda, Maryland.

Schneider, W. 1976. Beaver, Alaska: The Story of a Multi-Ethnic Community. Ph.D. dissertation, Bryn Mawr College.

Schoen, J.W., and M.D. Kirchhoff. 1982. Habitat Use by Mountain Goats in Southeast Alaska. Federal Aid in Wildlife Restoration Report, Projects W-17-10, W-17-11, W-21-1, and W-21-2, Job 12.4R. Alaska Department of Fish and Game, Juneau, Alaska.

Schoen, T.W., and L. Beier. 1990. Brown Bear Habitat Preferences and Brown Bear Logging and Mining Relationships in Southeastern Alaska. Federal Aid in Wildlife Restoration Final Report, Projects W-22-1 through W-22-6 and W-23-1 through W-23-3, Study 4.17. Alaska Department of Fish and Game, Juneau, Alaska.

Schroeder, R.F., D.B. Anderson, R. Bosworth, J.M. Morris, and J.M Wright. 1987. Subsistence in Alaska: Arctic, Interior, Southcentral, Southwest, and Western Regional Summaries. Technical Paper No. 150. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Schullery, P. 1980. The Bears of Yellowstone. Yellowstone Library and Museum Association, Yellowstone National Park, Wyoming.

Schwarber, J. 1983. Subsistence: An Overview. Manuscript prepared for State Representative, Mike Davis.

Scott, C.L., L.A. Brown, G.B. Jennings, and C.J. Utermohle. 2001. Community profile database. Alaska Department of Fish and Game, Division of Subsistence. Juneau, Alaska.

Scott, C.P. 1993. Continuity and Change in the Wiseman Area of Alaska: A Look at Land and Renewable Resource Use Over Time. M.S. thesis, University of Alaska.

Scott, R.F., E.F. Chatelain, and W.A. Elkins. 1950. The Status of the Dall Sheep and Caribou in Alaska. *North American Wildlife Conference,* 15:612-626.

SECOR. 1995. Analysis of Data Applicability for the Alaska North Slope Air Quality Management Program, Badami Development Project. SECOR International Inc. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska. March 1995.

SECOR. 1997b. TAPS Operating Permit Application, Valdez Marine Terminal. Submitted to Alaska Department of Environmental Conservation.SECOR International Inc. Prepared for Alyeska Pipeline Service Company, October 1997.

Sedinger, J., and A. Stickney. 2000. Black Brant *in:* J.C. Truett and S.R. Johnson (eds.). Natural History of an Arctic Oil

Field: Development and the Biota. Academic Press, San Diego, California.

Senner, R.G.B. 1989. Effects of Petroleum Operations in Alaskan Wetlands. Prepared by Robert Senner and Company. Prepared for ARCO Alaska, Inc. and BP Exploration (Alaska) Inc., Anchorage, Alaska.

Senner, R. 1999. Alyeska Pipeline Service Company, personal communication.

Senner, S.E. 1979. An Evaluation of the Copper River Delta as a Critical Habitat for Migrating Shorebirds. *Studies in Avian Biology* 2:131-145.

Seward, A., ed. 1985. Caribou. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-22-3, Job 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Sharp, B.E., M. Cody, and R. Turner. 1996. Effects of the *Exxon Valdez* Oil Spill on the Black Oystercatcher. Pages 748–758 *in:* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (eds.). Proceedings of the *Exxon Valdez* Oil Spill Symposium. American Fisheries Society Symposium No. 18. American Fisheries Society, Bethesda, Maryland.

Shaw, D.G., D.J. McIntosh, M.K. Hoberg, and A. Blanchard. 1999. Supplemental Studies of Hydrocarbons in Sediments of Port Valdez, Alaska, 1998. University of Alaska Institute of Marine Science.

Sheppard, W.L. 1999. Demographic, Economic, and Subsistence Profiles of Thirteen Communities Within and Near the Copper River Basin. Prepared by Sheppard Research, Portland, Oregon. Report submitted to Northern Land Use Research Inc., Fairbanks, Alaska.

Sheppard, W.L., and S.C. Gerlach 2000. Demographic, Economic, and Subsistence Profiles of Thirteen Communities within and Near the Copper River Basin, Vol. II. Prepared for ClearWater Environmental, Inc., Anchorage, Alaska.

Shepro, C.E., and D.C. Maas. 1999. North Slope Borough 1998/99 Economic Profile and Census Report: Volume VIII. Prepared for the North Slope Borough Department of Planning and Community Services, Barrow, Alaska.

Sherburne, J.L. 1993. Status Report on the Short-tailed Albatross *Diomedea albatrus*. Unpublished report prepared by Alaska Nat. Heritage Program, Environmental and Natural Resources Institute, University of Alaska, Anchorage.

Sherwood, K.W., and J.D. Craig. 2000. Prospects for Development of Alaska Natural Gas, a Review. U.S. Department of the Interior, Minerals Management Service.

Shideler, R.T., and J. Hechtel. 1995. Grizzly Bear Use of the North Slope Oil Fields. Paper presented at North Slope Environmental Studies Conference, 9-10 March 1995, BP Exploration (Alaska) Inc., Anchorage, Alaska. [abstract]

Shideler, R.T., and J. Hechtel. 2000. Grizzly Bear. Pages 105-132 *in:* J.C. Truett and S.R. Johnson (eds.). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Shideler, R. 1999. Alaska Department of Fish and Game. November 1, 1999, personal communication.

Shideler, R. 2000. Alaska Department of Fish and Game, Fairbanks, Alaska. April 5, 2000, personal communication.

Shinkwin, A.D. 1979. Dakah De'nin's Village and the Dixthada Site: A Contribution to Northern Athapaskan Prehistory. National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper No. 91.

Shishido, N. 1986. Seasonal distribution and winter habitat use by Sitka black-tailed deer in the Prince William Sound region, Alaska. M.S. Thesis, University of Alaska, Fairbanks.

Shoulders, M. 1999. Field Environmental Generalist/Alyeska Pipeline Service Company, personal communication, October 30, 1999.

Shur, Y. 1997. Design Depth of Frost Penetration Map, Alaska. Pages 419-420 *in:* Proceedings of the Fifth International Symposium on Cold Region Development. Published by ISCORD.

Shur, Y.L., and M.T. Jorgenson. 1998. Cryostructure Development on the Floodplain of the Colville River Delta, Northern Alaska. Pages 993-1000 *in:* A.G. Lewkowicz and M. Allard (eds.). Proceedings of Seventh International Conference on Permafrost. Collection Nordicana, No. 57. Universite Laval, Sainte-Foy, Quebec, Canada.

Silverstein, S. 1999. Alaska Railroad Corporation, personal communication, November 22, 1999.

Simeone, W.E. 1998. Managing Competition: The Copper River Fishery. *Cultural Survival Quarterly*, 22(3):53–57.

Simeone, W.E., and J.A. Fall. 1996. Patterns and Trends in the Subsistence Salmon Fishery of the Upper Copper River, Alaska. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska.

Simmons, G . 2000. Former engineer in charge of earthquake monitoring/Alyeska Pipeline Service Company, personal communication, January 17, 2000.

Simpson, S.G., M.E. Hogan, and D.V. Derksen. 1982. Behavior and Disturbance of Molting Pacific Black Brant in Arctic Alaska. Unpublished report prepared by US Fish and Wildlife Service, Anchorage, Alaska.

Singer, F.J. 1984. Aerial Dall Sheep Count, 1982, 1983, and 1984, Gates of the Arctic National Park and Preserve. Natural Resources Survey and Inventory Report AR/84-2. National Park Service, Anchorage, Alaska.

Singer, F.J., and J.L Doherty. 1985. Managing Mountain Goats at a Highway Crossing. *Wildlife Society Bulletin*, 13:469-477.

Siniff, D.B., and R.O. Skoog. 1964. Aerial Censusing of Caribou Using Stratified Random Sampling. *Journal of Wildlife Management*, 28:391-401.

Sinnott, R. 1994. Game Management Units 13D and 14, Talkeetna Mountains and Western Chugach Mountains. Pages 127-143 *in:* M.V. Hicks (ed.). Annual Report of

Survey-inventory Activities. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-1 and W-24-2, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Sinnott, R. 1996a. Game Management Units 11, 13D, 14A and 14C, Chugach Mountains. Pages 32-45 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1July 1992 - 30 June 1995. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1, W-24-2 and W-24-3, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

Sinnott, R. 1996b. Game Management Units 13D and 14, Talkeetna Mountains and Western Chugach Mountains. Pages 135-152 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1July 1993 - 30 June 1995. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2 and W-24-3, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Sinnott, R. 1999. Alaska Department of Fish and Game, personal communication, October 30 and November 26, 1999.

Sjolander, S., and G. Agren. 1976. Reproductive Behavior of the Yellow-billed Loon *Gavia adamsii*. *Condor,* 78:454–463.

Skoog, R.O. 1968. Ecology of the Caribou (*Rangifer tarandus granti*) in Alaska. Ph.D. thesis, University of California, Graduate Division, Berkeley, California.

Slaughter, C.W., C.H. Racine, D.A. Walker, L.A. Johnson, and G. Abele. 1989. Use of Off-road Vehicles and Mitigation of Effects of Alaska Permafrost Environments: A Review. *Environmental Management,* 14:63-72.

Sloan, C.E., C. Zenone, and L.R. Mayo. 1975. Icings Along the Trans-Alaska Pipeline Route. Open File Rep. 75-87. US Geological Survey, Anchorage, Alaska.

Slobodin, R. 1981. Kutchin. Pages 514–532 *in:* J. Helm (ed.). Handbook of the North American Indian: Subarctic. Vol. 6. Smithsonian Institution, Washington, D.C.

Small, R.J., and D.P. DeMaster. 1995. Alaska Marine Mammal Stock Assessments 1995. Technical Memorandum NMFS-AFSC-57. National Oceanic and Atmospheric Administration.

Smith, L.N., L.C. Byrne, C.B. Johnson, and A.A. Stickney. 1994. Wildlife Studies on the Colville River Delta, Alaska, 1993. Unpublished report prepared by Alaska Biological Research, Inc., Fairbanks, Alaska. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Smith, L.N., L.C. Byrne, and R.J. Ritchie. 1993. Wildlife Studies on the Colville River Delta, Alaska, 1992. Unpublished report prepared by Alaska Biological Research, Inc., Fairbanks, Alaska. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Smith, M.D. 1996. Distribution, Abundance, and Quality of Forage within the Summer Range of the Central Arctic Caribou Herd. M.S. thesis, University of Alaska, Fairbanks.

Smith, M.W., and R.S. Glesne. 1982. Aquatic Studies on the North Slope of the Arctic National Wildlife Refuge, 1981 and 1982. Fishery Research Progress Report FY83-1. US Fish and Wildlife Service, Fairbanks, Alaska.

Smith, R.A., J.R. Slack, T. Wyant, and K.J. Lanfear. 1982. The Oilspill Risk Analysis Model of the US Geological Survey. Geological Survey Professional Paper 1227. US Geological Survey, Washington, D.C.

Smith, T.E. 1984. Status of Muskoxen in Alaska. Biological Papers, University of Alaska Special Report No. 4:15-18.

Smith, T.G., and M.O. Hammill. 1981. Ecology of the Ringed Seal, *Phoca hispida*, in its Fast-ice Breeding Habitat. *Canadian Journal of Zoology* 59:966-981.

Smith, T.G., and I. Stirling. 1975. The Breeding Habitat of the Ringed Seal (*Phoca hispida*), the Birth Lair and Associated Structures. *Canadian Journal of Zoology* 53:1297-1305.

Smith, W.T. 1999. Analysis of Information Collected at the Dalton Highway Hunter Check Station, 1 August – 27 September 1998. Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, Alaska.

Smith, W.T., and R.D. Cameron. 1983. Responses of Caribou to Industrial Development on Alaska's Arctic Slope. *Acta. Zool. Fennica,* 175:43-45.

Smith, W.T., and R.D. Cameron. 1985. Reactions of Large Groups of Caribou to a Pipeline Corridor on the Arctic Coastal Plain of Alaska. *Arctic,* 38:53-57.

Smith, W.T., and R.D. Cameron. 1992. Caribou Responses to Development Infrastructures and Mitigation Measures Implemented in the Central Arctic Region. Pages 79-86 in: T.R. McCabe, B. Griffith, N.E. Walsh, and D.D. Young (eds.). Terrestrial Research: 1002 area — Arctic National Wildlife Refuge, Interim Report 1988-1990. US Fish and Wildlife Service, Anchorage, Alaska.

Snodgrass, R., C. Logsdon, and B. Heim. 1982. Alaskan Agriculture: A Overview. State of Alaska, Juneau, Alaska.

Snow, L., and S. Depue. 1990. State of Alaska Expenditures by Election District FY89. Alaska State Legislature, Legislative Research Agency, Juneau, Alaska.

Sobelman, S.S. 1985. The Economics of Wild Resource Use in Shishmaref, Alaska. Technical Paper No. 112. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Sonnenfeld, J. 1956. Changes in Subsistence Among the Barrow Eskimo. Ph.D. dissertation, Johns Hopkins University.

Sopuck, L.G., and D.J. Vernam. 1986a. Late Winter Distribution and Movements of Moose in Relation to the Trans-Alaska Pipeline in Interior Alaska. Prepared by Renewable Resources Consulting Services Ltd. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska.

Sopuck, L.G., and D.J. Vernam. 1986b. Distribution and Movements of Moose (*Alces alces*) in Relation to the Trans-Alaska Oil Pipeline. *Arctic*, 39:138-144.

Sorenson. S. 2000. Alyeska Pipeline Service Company, personal communication, November 15, 2000.

Spatt, P.D. 1978. Seasonal Variation of Growth Conditions on a Natural and Dust Impacted *Sphagnum* (Sphagnaceae) Community in Northern Alaska. M.S. thesis, University of Cincinnati, Cincinnati, Ohio.

SPCO. 1993. 1993 Annual Report. State Pipeline Coordinator's Office, Anchorage, Alaska.

SPCO. 1995. 1994 Annual Report. State Pipeline Coordinator's Office, Anchorage, Alaska.

Spencer, R.F. 1959. The North Alaskan Eskimo: A Study in Ecology and Society. Bureau of American Ethnology Bulletin 171.

Spindler, M.A. 1976. Ecological Survey of the Birds, Mammals, and Vegetation of Fairbanks Wildlife Management Area. M.S. thesis, University of Alaska, Fairbanks.

Spraker, T.H., W.B. Ballard, and S.D. Miller. 1981. Game Management Unit 13 Brown Bear Studies. Federal Aid in Wildlife Restoration Final Report, Projects W-17-10, W-17-11 and W-21-1, Job 4.13R. Alaska Department of Fish and Game, Juneau, Alaska.

Stanford, D. 1976. The Walakpa Site, Alaska: Its Place in the Birnik and Thule Cultures. Smithsonian Contributions to Anthropology, No. 20. Smithsonian Institution Press, Washington, D.C.

Starr, S.J., M.N. Kuwada, and L.L. Trasky. 1981. Recommendations for Minimizing the Impacts of Hydrocarbon Development on Fish, Wildlife and Aquatic Plant Resources of the Northern Bering Sea and Norton Sound. State of Alaska, Department of Fish and Game, Habitat Division, Anchorage, Alaska.

State of Alaska OMB. 1986. OMB Budget Studies. Office of Management and Budget.

Stears, C.D., O.C. Moghissi, and L. Bone. 1998. Use of Coupons to Monitor Cathodic Protection of an Underground Pipeline. Pages 23-31 *in: Material Performance* (NACE), February 1998.

Stehn, R.A., C.P. Dau, B. Conant, and W.I. Butler. 1993. Decline of Spectacled Eiders Nesting in Western Alaska. *Arctic*, 46:264-277.

Steller, G.W. 1988. Journal of a Voyage with Bering, 1741–1742 / George Wilhelm Steller. Stanford University Press.

Stephenson, B. 1999. Alaska Department of Fish and Game, personal communication, October 30, 1999.

Stephenson, R.O. 1986. Development of Lynx Population Estimation Techniques. Research Final Report, Federal Aid Wildlife Restoration, Project W-22-2, W-22-3, W-22-4, and W-22-5, Job 7.12R. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

Stephenson, R.O. 1993. Game Management Unit 26B North Slope and Arctic Coastal Plain. Pages 411-422 *in:* M.V. Hicks (ed.). Survey-inventory Management Report, 1 July 1989 – 30 June 1991. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-23-3 and W-23-4, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Stephenson, R.O. 1995. Game Management Units 25A, 25B, 25D, 26B and 26C Eastern North Slope of the Brooks Range. Pages 271-288 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Brown Bear. Federal Aid in Wildlife Restoration Report, Grants W-24-1 and W-24-2, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Stephenson, R.O. 1996a. Game Management Unit 26B North Slope and Arctic Coastal Plain. Pages 473-487 *in:* M.V. Hicks (ed.). Survey-inventory Management Report, 1 July 1993 – 30 June 1995. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-2 and W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Stephenson, R.O. 1996b. Game Management Units 24, 25A, 26B, and 26C, Eastern Brooks Range. Pages 148-157 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1July 1992 - 30 June 1995. Dall Sheep. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-1, W-24-2 and W-24-3, Study 6.0. Alaska Department of Fish and Game, Juneau, Alaska.

Stephenson, R.O. 1997. Game Management Units 25A, 25B, 25D, 26B and 26C, Eastern Interior, Eastern Brooks Range, and Central and Eastern Arctic Slope. Pages 171-182 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1993 – 30 June 1996. Federal Aid in Wildlife Restoration Report. Grants W-24-2 through W-24-4, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Stephenson, R.O., W.B. Ballard, C.A. Smith, and K. Richardson. 1995. Wolf Biology and Management in Alaska, 1981-1992. Pages 43-54 *in:* L.N. Carbyn, S.H. Fritts, and D.R. Seip (eds.). Ecology and Conservation of Wolves in a Changing World. Canadian Circumpolar Institute, Occasional Publication No. 35.

Stern, R., and D Gibson. 1982. Cultural Resource Survey of the New Chenega Village Site, Evans Island, Alaska. Manuscript on File. Alaska Office of History and Archaeology, Anchorage, Alaska.

Stern, R.O. 1982. Cultural Resources Investigation Along the Richardson Highway, Milepost 129 to 185, Glenn-Rich Junction to Paxson, Alaska. Prepared by Alaska Department Natural Resources, Division of Geological and Geophysical Surveys. Prepared for Alaska Department of Transportation and Public Facilities.

Stevens Village Council. 1999. Stevens Village Land Use Plan, Ethnogeography of Ancestral Lands and Integrated Resource Management Plan.

Stevick G., J. Hart, and B. Flanders. 1998. Fatigue Curves for

Damage Calculations for a Dented and Ovaled Section of the Trans-Alaska Pipeline System, International Pipeline Conference, Calgary, Alberta, Canada.

Stickel, L.F. and M.P. Dieter. 1979. Ecological and Physiological/Toxicological Effects of Petroleum in Aquatic Birds. A suMmary of Research Activities FY 1976 through FY 1978. FWS/OBS-79/23. US Fish and Wildlife Service, Biological Services Program, Slidell, Louisiana.

Stickney, A.A., R.J. Ritchie, B.A. Anderson, and D.A. Flint. 1994. Tundra Swan and Brant Surveys on the Arctic Coastal Plain, Colville River to Sagavanirktok River, 1993. Unpublished report prepared by Alaska Biological Research, Inc. Prepared for ARCO Alaska, Inc., Anchorage, Alaska.

Stimmelmayr, R. and L.A. Renecker. 1998. Translocations of Introduced Reindeer from Hagemeister Island, Alaska. *Rangifer* 18(1):19-25.

Stirling, I. 1974. An Overwintering Walrus in the Beaufort Sea. *Murrelet* 55:40-41.

Strandberg. B. 1997. Vegetation Recovery Following Anthropogenic Disturbances in Greenland. p. 381-390. *in*: R.M.M. Crawford (ed.). Disturbance and Recovery in Arctic lands: An Ecological Perspective. Kluwer Academic, Dordrecht, The Netherlands.

Stratton, L. 1989. Resource Use in Cordova, A Coastal Community of Southcentral Alaska. Technical Paper No. 153. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Stratton, L. 1990. Resource Harvest and Use in Tatitlek, Alaska. Technical Paper No. 181. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Stratton, L. 1992. Cordova: A 1988 Update on Resource Harvests and Uses. Technical Paper No. 204. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Stratton, L., and E.B. Chisum. 1986. Resource Use Patterns in Chenega, Western Prince William Sound: Chenega in the 1960s and Chenega Bay 1984–1986. Technical Paper No. 139. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska.

Stratton, L., and S. Georgette. 1984. Use of Fish and Game by Communities in the Copper River Basin, Alaska: A Report on a 1983 Household Survey. Technical Report No. 107. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska.

Strong, S.B. 1977. Alaska Pipeline: Social and Economic Impact on Native People. Environmental–Social Program, Northern Pipelines (Canada). Minister of Indian and Northern Affairs, Ottawa, Ontario, Canada.

Stubblefield, W.A., G.A. Hancock, W.H. Foed, H.H. Prince, and R.K. Ringer. 1995. Evaluation of the Toxic Properties of Naturally Weathered *Exxon Valdez* Crude Oil to Wildlife Species. Pages 665-692 *In*: P.G. Wells, J.A. Butler, and J.S. Hughes, (eds.). *Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters. 3rd Symposium on Environmental Toxicology and Risk Assessment: Aquatic, Plant, and Terrestrial.. ASTMSTP 1219. American Society for Testing and Materials, Philadelphia, Pennsylvania.

St. Vladimir's Orthodox Theological Seminary. 1999. Eastern Orthodox Parishes, Institutions, and Monasteries in Alaska. From web site: http://www.svots.edu/directory/US-Alaska.html.

Sumida, V.A. 1988. Land and Resource Use Patterns in Stevens Village, Alaska. Technical Paper No. 129. Alaska Department of Fish and Game, Division of Subsistence.

Suydam, R.S. 1999. North Slope Borough, Department of Wildlife Management, personal communication..

Swem, T. 1999. Endangered Species Biologist, U.S. Fish and Wildlife Service, Fairbanks, Alaska, personal communication, August 15, 1999.

Swenson, J.E. 1985. Compensatory Reproduction in an Introduced Mountain Goat Population in the Absaroka Mountains, Montana. *Journal of Wildlife Management*, 49:837-843.

Tamura, T., Y. Fujise, and K. Shimazaki. 1998. Diet of Minke Whales *Balaenoptera acutorostrata* in the Northwestern Part of the North Pacific in Summer, 1994 and 1995. *Fisheries Science,* 64:71–76.

Tart, R. Jr., and J. Hughes. 1998. In-Situ Evaluation of Pipeline Bedding and Padding Spring Constants. International Pipeline Conference, Calgary, Alberta, Canada.

Taylor, K.P. 1993a. Region III Furbearer Population and Habitat Management. Pages 15-25 *in:* S.M. Abbot (ed.). Furbearers. Annual Performance Report of Survey-inventory Activities, 1 July 1992-30 June 1993. Volume XXIV, Part XIV. Federal Aid in Wildlife Restoration Project W-24-1, Study 7.0. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

Taylor, K.P. 1993b. Unit 24. Pages 248-254 *in:* M.V. Hicks (ed.). Management Report of Survey-Inventory Activities, 1 July 1990-30 June 1992. Federal Aid in Wildlife Restoration Projects W-23-4 and W-23-5, Study 4.0. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

Taylor, K.P. 1994a. Game Management Unit 20D, Delta Bison Herd Population and Habitat Management 1991-1993. Pages 26-51 *in:* M.V. Hicks (ed.). Survey-inventory Management Report. Bison. Federal Aid in Wildlife Restoration Progress Report, Grants W-23-5 and W-24-1, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

Taylor, K.P. 1994b. Interior Furbearer Population and Habitat Management. Pages 13-21 *in:* M.V. Hicks (ed.). Furbearers. Annual Performance Report of Survey-inventory Activities, 1 July 1993-30 June 1994. Federal Aid in Wildlife Restoration Grant W-24-2, Study 7.0. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

Taylor, K.P. 1995. Region III Furbearer Population Management. Pages 14-23 *in:* M.V. Hicks (ed.). Furbearers. Annual Performance Report of Survey-inventory Activities, 1 July 1994-30 June 1995. Federal Aid in Wildlife Restoration Grant W-24-3, Study 7.0. Alaska Department of Fish and Game, Division of Wildlife Conservation, Juneau, Alaska.

Taylor, K.P. 1996. Interior Furbearer Population and Habitat Management. Pages 14-23 *in:* M.V. Hicks (ed.). Furbearers. Annual Performance Report of Survey-inventory Activities, 1 July 1994-30 June 1995. Federal Aid in Wildlife Restoration Grant W-24-3, Study 7.0. Alaska Department of Fish and Game, Division of Wildlife Conservation.

Tedrow, J.C.F., and J. Brown. 1967. Soils of Arctic Alaska. Pages 238-294 *in:* H.E. Wright Jr. and W.H. Osburn (eds.). Arctic and Alpine Environments. Indiana University Press, Bloomington, Indiana.

TERA. 1990. The Fate of Birds Displaced by the Prudhoe Bay Oilfield: the Distribution of Nesting Birds Before and After P-pad Construction. Unpublished report. Troy Ecological Research Associates. Sponsored by BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA. 1993b. Bird Use of the Prudhoe Bay Oil Field. Troy Ecological Research Associates. Final report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA. 1994. Bird Use of Coastal Tundra at Prudhoe Bay, Alaska: 1991–1992. Troy Ecological Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA. 1995. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1991-1993. Troy Ecological Research Associates. Unpublished report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA. 1996b. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1995 Status Report. Troy Ecological Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska,

TERA. 1997. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1996 Status Report. Prepared by Troy Ecological Research Associates, Anchorage, Alaska. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA. 1999. Spectacled Eiders in the Beaufort Sea: Distribution and Timing of Use. Troy Ecological Research Associates. Unpublished report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Testa, J.W. 1999. Population Dynamics of Moose and Predators in Game Management Unit 13. Federal Aid in Wildlife Restoration Research Progress Report, Grant W-27-1, Study 1.49. Alaska Department of Fish and Game, Juneau, Alaska.

Thileneus, J.F. 1995. Phytosociology and Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska. General Technical Report PNW-GTR-346. US Forest Service, Pacific Northwest Research Station.

Thomas, C.P., R.B. Allaire, T.C. Doughty, D.D. Faulder, J.S. Irving, H.C. Jamison, and G.J. White. 1993. Alaska North Slope National Energy Strategy Initiative. Idaho National Engineering and Environmental Laboratory (INEEL), Idaho Falls, Idaho. DOE/ID/01570–TI164 (DE93000142).

Thomas, D.C., and J.E. Edmonds. 1984. Competition Between Caribou and Muskoxen, Melville Island, NWT, Canada. Pages 93-100 *in:* D.R. Klein, R.G. White, and S. Keller (eds.). Proceedings of the First International Muskox Symposium. University of Alaska, Special Report No. 4.

Thomas, D.C., and H.P.L. Kiliaan. 1990. Warble Infestations in Some Canadian Caribou and Their Significance. *Rangifer,* Special Issue No. 3:409-417.

Thomas, H.P., and J.E. Ferrell. 1983. Thermokarst Features Associated with Buried Sections of the Trans-Alaska Pipeline. Pages 1245-1250 *in:* Permafrost Fourth International Conference Proceedings. National Academy Press, Washington, D.C.

Thomas, M., S. Fison, and R. Solie. 1977. The Impact of the Trans-Alaska Oil Pipeline on Fairbanks, Alaska. Presented at the Northwest Regional Economic Conference, University of Oregon.

Thomas, C.P., T.C. Doughty, J.H. Hackworth, W.B. North, and E.P. Robertson. 1996. Economics of Alaska North Slope Gas Options. Idaho National Engineering Laboratory, Idaho Falls, Idaho.

Thompson, M. 1999. Alaska Department of Fish and Game, personal communication, October 30, 1999.

Thompson, M.J., and R.E. Henderson. 1998. Elk Habituation as a Credibility Challenge for Wildlife Professionals. *Wildlife Society Bulletin*, 26:477-483.

Thurber, J.M., R.O. Peterson, T.D. Drummer, and S.A. Thomasma. 1994. Gray Wolf Response to Refuge Boundaries and Roads in Alaska. *Wildlife Society Bulletin,* 22:61-68.

Tieszen, L.L. 1978. Vegetation and Production Ecology of an Alaskan Arctic Tundra. Ecological Studies 29, Springer-Verlag, New York, New York.

Tobey, R.W. 1981a. Game Management Unit 11, Copper River Herd. Pages 3-5 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities. Part III Bison. Federal Aid in Wildlife Restoration Progress Report, Project W-17-12, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1981b. Game Management Unit 13, Nelchina Basin. Pages 30-31, 70-72 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities, January 1 1980 – December 30 1980. Part 1. Black Bears and Brown Bears. Federal Aid in Wildlife Restoration, Vol. XII, Projects W-19-1 and W-19-2, Jobs 17.0, 4.0 and 22.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1989. Game Management Unit 13, Nelchina Basin. Pages 57-61 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Part IV. Black Bears. Federal Aid in Wildlife Restoration Progress Report, Vol. XIX. Projects W-23-1, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1991a. Game Management Unit 13, Nelchina Basin. Pages 111-123 *in:* S.A. Abbott (ed.). Management Report of Survey-inventory Activities, July 1 1990 – June 30 1991. Brown Bear. Federal Aid in Wildlife Restoration Report, Project W-23-4, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1991b. Game Management Unit 13, Nelchina and Upper Susitna Rivers. Pages 62-70 *in:* S.M. Abbott (ed.). Management Report of Survey-inventory Activities, 1 July 1989 – 30 June 1991. Wolf. Federal Aid in Wildlife Restoration Report, Grants W-23-3 and W-23-4, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1994a. Game Management Unit 11 – Copper River Herd, 1991-1993. Pages 1-9 *in:* M.V. Hicks (ed.). Survey-inventory Management Report. Bison. Federal Aid in Wildlife Restoration Progress Report, Grant W-24-1, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1994b. Game Management Unit 11, Wrangell Mountains. Pages 119-126 *in:* M.V. Hicks (ed.). Annual Report of Survey-inventory Activities. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-1 and W-24-2, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1995a. Game Management Units 13 and 14B, Nelchina Caribou Herd. Pages 78-91 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1992-30 June 1994. Caribou. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2 and W-24-3, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1995b. Game Management Unit 13, Nelchina Basin. Pages 123-134 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Brown Bear. Federal Aid in Wildlife Restoration Report, Grants W-24-1 and W-24-2, Study 4.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1996a. Game Management Unit 13 Nelchina and Upper Susitna Rivers. Pages 111-127 *in:* M.V. Hicks (ed.). Survey-inventory Management Report, 1 July 1993 – 30 June 1995. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-2 and W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1996b. Game Management Unit 11 Chitina Valley and Eastern Half of Copper River Basin. Pages 90-97 *in:* M.V. Hicks (ed.). Survey-inventory Management Report, 1 July 1993 – 30 June 1995. Moose. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-2 and W-24-3, Study 1.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1996d. Game Management Unit 11, Wrangell Mountains. Pages 127-134 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1July 1993 - 30 June 1995. Mountain Goat. Federal Aid in Wildlife Restoration Progress Report, Grants W-24-2 and W-24-3, Study 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1996e. Game Management Unit 13, Nelchina Basin. Pages 106-112 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, July 1 1992 – June 30 1995. Black Bear. Federal Aid in Wildlife Restoration Progress Report. Grants W-24-1 through W-24-3, Study 17.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1997. Game Management Unit 13, Nelchina and Upper Susitna Rivers. Pages 63-70 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1993 – 30 June 1996. Federal Aid in Wildlife Restoration Report, Grants W-24-2 through W-24-4, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1998. Game Management Unit 11 – Copper River Herd, 1995-1997. Pages 1-8 *in:* M.V. Hicks (ed.). Survey-inventory Management Report. Bison. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-4 and W-24-5, Study 9.0. Alaska Department of Fish and Game, Juneau, Alaska.

Tobey, R.W. 1999. Alaska Department of Fish and Game, personal communication, June 29, 1999.

Tomilin, A.G. 1957. Animals of the USSR and Adjacent Countries. Volume 9. Cetaceans. Academy of Science, Moscow, Russia.

Tomrdle, L., and R. A. Miraglia. 1993. Use of Fish and Wildlife in Valdez, Prince William Sound, Alaska. Alaska Department of Fish and Game, Division of Subsistence, Anchorage, Alaska. Prepared for US Forest Service.

Tonkins, W.G., U.J. Baskurt, and J. Hart. 1998. Trans-Alaska Pipeline System Linewide Slackline Investigations for Potential Pipe Vibrations. International Pipeline Conference, Calgary, Alberta, Canada.

Townsend, B., ed. 1986. Caribou. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-22-4, Job 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Townsend, B., ed. 1987. Caribou. Annual Performance Report of Survey-Inventory Activities. Federal Aid in Wildlife Restoration, Project W-22-5, Job 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Treacy, S.D. 1988-98. Aerial Surveys of Endangered Whales in the Beaufort Sea. Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

Treacy, S.D. 1999. Project Manager, Bowhead Whale Surveys,

Minerals Management Service, Anchorage, Alaska, personal communication.

Treshow, M. 1970. Environment and Plant Response. Mcgraw Hill, New York, New York.

Troy, D.M. 1991. Bird Use of Disturbed Tundra at Prudhoe Bay, Alaska: Bird and Nest Abundance Along the Abandoned Peat Roads, 1988-1989. Final report prepared by Troy Ecological Research Associates, Anchorage, Alaska. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Troy, D.M. 1993. Tundra Birds. Chapter IV and Appendix IV *in:* Prudhoe Bay Waterflood Environmental Monitoring Program 1987. US Army Corps of Engineers, Alaska District, Anchorage, Alaska.

Troy, D.M. 2000. Shorebirds. Pages 277-303 *in:* J.C. Truett, and S.R. Johnson (eds.). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Troy, D.M., and T.A. Carpenter 1990. The Fate of Birds Displaced by the Prudhoe Bay Oil Field: The Distribution of Nesting Birds Before and After P-Pad Construction. Unpublished report prepared by Troy Ecological Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Trudgen, D. 1999. Biologist/OASIS Environmental Inc. (formerly with Alyeska), personal communication, October 30, 1999.

Truett, J.C., and S.R. Johnson (eds.). 2000. The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, California.

Truett, J.C., and K. Kertell. 1992. Tundra Disturbance and Ecosystem Production: Implications for Impact Assessment. *Environmental Management,* 16:485-494.

Truett, J.C., R.G.B. Senner, K. Kertell, R. Rodrigues, and R.H. Pollard. 1994. Wildlife Response to Small-scale Disturbances in Arctic Tundra. *Wildlife Society Bulletin,* 22:317–324.

Tuck, B. 1982. Petroleum Industry Expansion in Alaska and Structural Change. Prepared for Alaska Outer Continental Shelf Leasing Office.

Tumlison, R. 1987. *Felis lynx*. Mammalian Species No. 269, American Society of Mammalogists.

Tussing, A. 1984. Alaska's Petroleum Based Economy. *in:* T. Morehouse (ed.). Alaska's Resource Development: Issues of the 1980s. Westview Press, Boulder, Colorado.

Tyler, B.L. 1991. Short-term Behavioral Responses of Svalbard Reindeer *Rangifer tarandus platyrhynchus* to Direct Provocation by a Snowmobile. *Biological Conservation,* 56:179-194.

Underwood, L., and J.A. Mosher. 1982. Arctic Fox. Chapter 23 *in:* J.A. Chapman and G.A. Feldhamer (eds.). Wild Mammals of North America. John Hopkins University Press, Baltimore, Maryland.

Underwood, T.J., J.A. Gorden, M.J. Millard, L.A. Thorpe, and B.M. Osborne. 1995. Characteristics of Selected Fish Populations of Arctic National Wildlife Refuge Coastal Waters, Final Report, 1988-1991. Alaska Fisheries Technical Report No. 28. US Fish and Wildlife Service, Fairbanks, Alaska.

United Nations. Various years. Commodity Trade Statistics: Statistical Papers. United Nations, New York, New York.

University of Alaska. 1998. Cost of Food at Home for a Week. Cooperative Extension Service.

Uren, L.C. 1953. Petroleum Production Engineering Oil Field Exploration. Third edition. McGraw-Hill Book Company, New York, New York.

US Army Space and Missile Defense Command. 1999. National Missile Defense Development Draft Environmental Impact Statement. Huntsville, Alabama.

US Army. 1969. The Army's Role in the Building of Alaska. Pamphlet 360–5. US Army, Public Information Officer Headquarters, Anchorage, Alaska.

USACE. 1980. Prudhoe Bay Oil Field Waterflood Project. Final Environmental Impact Statement. U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

USACE. 1984. Prudhoe Bay Oil Field, Endicott Development Project. Final Environmental Impact Statement. US Army Corps of Engineers, Alaska District, Anchorage, Alaska.

USACE. 1987. 1985 Final Report for the Endicott Monitoring Program, Volume 3, Oceanographic Monitoring. US Army Corps of Engineers, Alaska District, Anchorage, Alaska.

USACE. 1987a. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi.

USACE. 1990. 1986 Final Report for the Endicott Monitoring Program, Volume 2, Oceanography. US Army Corps of Engineers, Alaska District.

USACE. 1997. Alpine Development Project: Environmental Evaluation Document. US Army Corps of Engineers, Alaska District, Anchorage, Alaska.

USACE. 1999. Final Environmental Impact Assessment, Beaufort Sea Oil and Gas Development/ Northstar Project. US Army Corps of Engineers, Alaska District, Anchorage, Alaska.

USDOE. 1994. Exporting Alaskan North Slope Crude Oil Benefits and Costs. U.S. Department of Energy, Washington, D.C.

USDOE. 1998. Comprehensive National Energy Strategy, DOE/S–0124, US Department of Energy, Washington, D.C.

USDOE. 1998b. Annual Energy Outlook 1999 with Projections to 2020 .U.S. Department of Energy, Office of Integrated Analysis and Forecasting, Washington, D.C. DOE/ EIA–0383(99).

USDOE. 1999. Natural Gas Annual. U.S. Department of Energy.

USDOE. 2000. Natural Gas Processing Program Strategic Objectives. From web site: www.fe.doe.gov. U.S. Department of Energy, Washington, D.C.

USDOE. 2000a. Natural Gas Monthly. U.S. Department of Energy, Energy Information Administration, Washington, D.C.

USGS. 1972. Channel Erosion Surveys Along Proposed TAPS Route, July 1971. U.S. Geological Survey, Anchorage, Alaska.

USGS. 1975. Channel Erosion Surveys Along TAPS Route, Alaska, 1975. U.S. Geological Survey, Anchorage, Alaska.

USGS. 1976. Channel Erosion Surveys Along TAPS Route, Alaska, 1976. U.S. Geological Survey, Anchorage, Alaska.

USGS. 1977. Channel Erosion Surveys Along TAPS Route, Alaska, 1977. U.S. Geological Survey, Anchorage, Alaska.

USGS. 1999. North American Breeding Bird Survey ftp data set, version 1998.1. U.S. Geological Survey, Patuxent Wildlife Research Center, Maryland.

Valkenburg, P. 1993. Game Management Units 26B and 26C, Central Arctic Herd. Pages 225-233 *in:* S.M. Abbott, (ed.). Survey-inventory Management Report. Caribou. Federal Aid in Wildlife Restoration Report, Projects W-23-5 and W-24-1, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Valkenburg, P. 1997. Investigation of Regulating and Limiting Factors in the Delta Caribou Herd. Federal Aid in Wildlife Restoration Research Final Report 1 July 1991 – 30 June 1996, Grants W-23-5, W-24-1 through W-24-4, Study 3.37. Alaska Department of Fish and Game, Juneau, Alaska.

Valkenburg, P. 1999. Wildlife Notebook Series: Caribou. Prepared for Alaska Department of Fish and Game. From web site: www.state.ak.us/local/akpages/FISH.GAME/notebook/biggame/caribou.htm.

Valkenburg, P., and J.L. Davis. 1984. The Reaction of Caribou to Aircraft: A Comparison of Two Herds. Pages 7-9 *In*: A.M. Martell and D.E. Russell (eds.). Caribou and Human Activity. Proceedings of the First North American Workshop, Sept 28-29, 1983, Whitehorse, Yukon Territories. Canadian Wildlife Service, Ottawa, Ontario, Canada.

Valkenburg, P., and J.L. Davis. 1986. Calving Distribution of Alaska's Steese-Fortymile Caribou Herd: A Case of Infidelity? *Rangifer,* Special Issue No. 1:315-323.

Valkenburg, P., B. Dale, B.W. Tobey, and R.A. Sellers. 1999. Investigation of Regulating and Limiting Factors in the Delta Caribou Herd. Federal Aid in Wildlife Restoration Research Progress Report 1 July 1997 – 30 June 1997, Grant W-27-1, Study 3.42. Alaska Department of Fish and Game, Juneau, Alaska.

Valkenburg, P., J. L. Davis, and D.J. Reed. 1988. Distribution of Radio-collared Caribou from the Delta and Yanert Herds During Calving. Proceedings of the 3rd North American Caribou Workshop. Wildlife Technical Bulletin No. 8:14-32. Alaska Department of Fish and Game. Juneau, Alaska.

Valkenburg, P.L. 1988. White Mountains Caribou Herd Survey-inventory Progress Report. Pages 51-53 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Vol XVIII Caribou. Part XI. Federal Aid in Wildlife Restoration Progress Report, Project W-22-6. Alaska Department of Fish and Game, Juneau, Alaska.

Van Ballenberghe, V. 1978. Final Report on the Effects of the Trans-Alaska Pipeline on Moose Movements. Special Report No. 23. Prepared for the Joint State/Federal Fish and Wildlife Advisory Team, Anchorage, Alaska.

Van Ballenberghe, V. 1985. Wolf Predation on Caribou: The Nelchina Herd Case History. *Journal of Wildlife Management,* 49:711-720.

Van Ballenberghe, V. 1988. Wolf Predation on Nelchina Herd Caribou: A Comment. *Journal of Wildlife Management,* 52:243-250.

Van Cleve, K., and J. Manthei. 1973. Report on Tundra-taiga Surface Stabilization Study. Prepared by Institute of Arctic Biology, University of Alaska, Fairbanks. Submitted to Alyeska Pipeline Service Company, Inc.

Van Cleve, K., F.S. Chapin III, C.T. Dyrness, and L.A. Viereck. 1991. Element Cycling in Taiga Forests: State Factor Control. *Bioscience,* 41:78-88.

Van Dyke, F., and W.C. Klein. 1996. Response of Elk to Installation of Oil Wells. *Journal of Mammology,* 77:1028-1041.

VanStone, J.W. 1955. Exploring the Copper River Country. *Pacific Northwest Quarterly,* 46:115–123.

VanStone, J.W. 1962. 1961 Point Hope: An Eskimo Village in Transition. University of Washington Press, Seattle, Washington.

VanStone, J.W., and I. Goddard. 1981. Territorial Groups of West Central Alaska before 1898. Vol. 6. Pages 556-561 *in:* J. Helm, (ed.). Handbook of North American Indians: Subarctic. Smithsonian Institution, Washington, D.C.

Van Valin, W.B. 1945. Eskimoland Speaks. The Caxton Printers, Ltd., Caldwell, Idaho.

Viereck, L.A. 1973. Wildfire in the Taiga of Alaska. *Journal of Quaternary Research,* 3:465-495.

Viereck, L.A. 1975. Forest Ecology of the Alaskan Taiga. Pages I1-I22 *in:* Proceedings of the Circumpolar Conference on Northern Ecology, Ottawa, Canada, September 15-18, 1975. National Research Council of Canada.

Viereck, L.A. 1979. Characteristics of Treeline Plant Communities in Alaska. *Holarctic Ecology,* 2:228-238.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlik. 1992. The Alaska vegetation classification system. U.S. Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Viereck, L.A., C.T. Dyrness, and M.J. Foote. 1993. An Overview of the Vegetation and Soils of the Floodplain Ecosystems of the Tanana River, Interior Alaska. *Canadian Journal of Forest Research,* 23:889-898.

Viereck, L.A., K. Van Cleve, and C.T. Dyrness. 1986. Forest Ecosystem Distribution in the Taiga Environment. Pages 22-43 *in:* K. Van Cleve, F.S. Chapin III., P.W. Flanagan, L.A. Viereck, and C.T. Dyrness (eds.). Forest Ecosystems in the Alaska Taiga: A Synthesis of Structure and Function. Springer-Verlag, New York, New York.

Vitt, D.H., J.E. Marsh, and R.B. Bovey. 1988. Mosses, Lichens, and Ferns of Northwest North America. Lone Pine Publishing, Edmonton, Alberta, Canada.

Von Ziegesar, O., E. Miller, and M.E. Dahlheim. 1994. Impacts on Humpback Whales in Prince William Sound. Pages 173-191 *in:* T.R. Loughlin, (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Vyalov, S.S., A.S. Gerasimov, A.I. Zolotar, and S.M. Fotiev. 1993. Ensuring Structural Stability in Permafrost Ground Areas at Global Warming of the Climate. Pages 955-960 *in:* Proceedings of the Sixth International Conference on Permafrost, Beijing, China.

Vyalov, S.S., A.S. Gerasimov, and S.M. Fotiev. 1998. Influence of Global Warming on the State and Geotechnical Properties of Permafrost. Pages 1097-1102 *in:* Proceedings of the Seventh International Conference on Permafrost, Yellowknife, Northwest Territories, Canada.

Wahrhaftig, C. 1965. Physiographic Divisions of Alaska: U.S. Geological Survey Professional Paper 482.

Walker, A. 1982. An Account of a Voyage to the Northwest Coast in 1785 and 1786. University of Washington Press, Seattle, Washington.

Walker, D.A. 1983. A Hierarchical Tundra Vegetation Classification Especially Designed for Mapping in Northern Alaska. Pages 1332-1337 *in:* Permafrost: Fourth International Conference Proceedings, 1983 July 17-22, Fairbanks, Alaska. National Academy Press, Washington, D.C

Walker, D.A. 1985. Vegetation and Environmental Gradients of the Prudhoe Bay Region, Alaska. CRREL Report 85-14, U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Walker, D.A. 1999. University of Alaska Fairbanks, personal communication.

Walker, D.A., and W. Acevedo. 1987. Vegetation and a Landsat-derived Land Cover Map of the Beechey Point Quadrangle, Arctic Coastal Plain, Alaska. CRREL Report 87-5. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Walker, D.A., and K.R. Everett. 1987. Road Dust and its Environmental Impact on Alaska Taiga and Tundra. *Arctic and Alpine Research,* 19:479-489.

Walker, D.A., and K.R. Everett. 1991. Loess Ecosystems of Northern Alaska: Regional Gradient and Toposequence at Prudhoe Bay. *Ecological Monographs,* 6:437-464.

Walker, D.A., and M.D. Walker. 1991. History and Pattern of Disturbance in Alaskan Arctic Terrestrial Ecosystems: A Hierarchical Approach to Analyzing Landscape Change. *Journal of Applied Ecology,* 28:244-276.

Walker, D.A., E. Binnian, B.M. Evans, N.D. Lederer, E. Nordstand, and P.J. Webber. 1989. Terrain, Vegetation and Landscape Evolution of the R4D Research Site, Brooks Range Foothills, Alaska. *Holarctic Ecology,* 12:238-261.

Walker, D.A., D. Cate, J. Brown, and C. Racine. 1987. Disturbance and Recovery of Arctic Alaskan Tundra Terrain: A Review of Recent Investigations. CRREL Report 87-11. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Walker, D.A., K.R. Everett, P.J. Webber, and J. Brown. 1980. Geobotanical Atlas of the Prudhoe Bay Region, Alaska. Laboratory Report 80-14. U.S. Army Corps of Engineers Cold Regions Research and Engineering, Hanover, New Hampshire.

Walker, D.A., P.J. Webber, E.F. Binnian, K.R. Everett, N.D. Lederer, E.A. Nordstrand, and M.D. Walker. 1987. Cumulative Impacts of Oil Fields on Northern Alaska Landscapes. *Science,* 238:757-761.

Walker, D.A., P.J. Webber, K.R. Everett, and J. Brown. 1978. Effects of Crude and Diesel Oil Spills on Plant Communities at Prudhoe Bay, Alaska, and the Derivation of Oil Spill Sensitivity Maps. *Arctic,* 31(3):242-259.

Walker, D.A., P.J. Webber, M.D. Walker, N.D. Lederer, R.H. Meehan, and E.A. Nordstrand. 1986. Use of Geobotanical Maps and Automated Mapping Techniques to Examine Cumulative Impacts in the Prudhoe Bay Oilfield, Alaska. *Environmental Conservation,* 13: 149-160.

Walker, H.J. 1973. Morphology of the North Slope. Arctic Institute of North America, Technical Paper 25:49-92.

Walker, M.D., D.A. Walker, and K.R. Everett. 1989. Wetland Soils and Vegetation, Arctic Foothills, Alaska. U.S. Fish and Wildlife Service Biological Report 89(7).

Walker, M.D., D.A. Walker, and N.A. Auerbach. 1994. Plant Communities of a Tussock Tundra Landscape in the Brooks Range Foothills, Alaska. *Journal of Vegetation Science,* 5:843-866.

Ward, D.H., R.A. Stehn, and D.V. Derksen. 1994. Response of Staging Brant to Disturbance at Izembek Lagoon, Alaska. *Wildlife Society Bulletin,* 22:220-228.

Warnock, N.D., and D.M. Troy. 1992. Distribution and Abundance of Spectacled Eiders at Prudhoe Bay, Alaska: 1991. Unpublished report prepared by Troy Ecological Research Associates. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Webber, P.J. 1978. Spatial and Temporal Variation of the Vegetation and its Production, Barrow, Alaska. Pages 37-112 *in:* L.L. Tieszen (ed.) Vegetation and Production Ecology of an Alaskan Arctic Tundra. Ecological Studies 29. Springer-Verlag, New York, New York.

Weber B., and M. Malvick. 2000. Trans-Alaska Pipeline System Mainline Block Valve Risk Assessment. ETCE/OMAE 2000.

Webber, P.J., and J.D. Ives. 1978. Damage and Recovery of Tundra Vegetation. *Environmental Conservation,* 5:171-182.

Webber-Scannell, P. 2000. Alaska Department of Fish and Game, Fairbanks, Alaska, personal communication with Laurie Hulse, Montgomery-Watson, Anchorage, Alaska. November 17, 2000.

Wein, R.W. and L.C. Bliss. 1973. Experimental Crude Oil Spills on Arctic Plant Communities. *Journal of Applied Ecology,* 10:671-682.

Welsh, S. L. 1974. Anderson's Flora of Alaska and Adjacent Parts of Canada. Brigham Young University Press, Provo, Utah.

Wells, P.G., J.N. Butler, and J.S. Hughes (eds.). 1995. *Exxon Valdez*: Fates and Effects in Alaskan Waters. Special Technical Publication 1219. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Wenzel, K.E. 1998. What Put the Small in the Arctic Small Tool Tradition: Raw Material Constraints on Lithic Technology at the Mosquito Lake Site, Alaska. M.A. thesis. Eastern New Mexico University, Portales, New Mexico.

West, F.H. 1967. The Donnelly Ridge Site and the Definition of an Early Core and Blade Complex in Central Alaska. *American Antiquity,* 32(3):360–382.

West, F.H. 1996. American Beginnings. University of Chicago Press, Chicago, Illinois.

West, R.L., and D.W. Wiswar. 1985. Fisheries Investigations on the Arctic National Wildlife Refuge, Alaska, 1984. Pages 729-777 *in:* G.W. Garner and P.E. Reynolds (eds.). Arctic National Wildlife Refuge Coastal Plain Resource Assessment: 1984 Update Report. U.S. Fish and Wildlife Service, Anchorage, Alaska.

White, C.M., T.D. Ray, and L.W. Sowl. 1977. The 1970-1972-1974 Raptor Surveys Along the Trans-Alaska Oil Pipeline. Pages 222-229 *in:* World Conference on Birds of Prey. International Council on Bird Preservation, Vienna, Austria.

White, R.G. 1983. Forage Patterns and Their Multiplier Effects on Productivity of Northern Ungulates. *Oikos,* 40:377-384.

White, R.G., B.R. Thomson, T. Skogland, S.J. Person, D.E. Russell, D.F. Holleman, and J.R. Luick. 1975. Ecology of Caribou at Prudhoe Bay, Alaska. Pages 151-201 *in:* J. Brown (ed.) Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska. Special Report 2. University of Alaska, Fairbanks.

Whitman, J.S., W.B. Ballard, and C.L. Gardner. 1986. Home Range and Habitat Use by Wolverines in Southcentral Alaska. *Journal of Wildlife Management,* 50:460-463.

Whitney, D. 1999. Global Success of Oil Pollution Act Praised. *Anchorage Daily News*. Metro Section, pg B1. March 25, 1999.

Whittaker, D., and R.L. Knight. 1998. Understanding Wildlife Responses to Humans. *Wildlife Society Bulletin,* 26:312-317.

Whitten, K. 1997. Alaska Department of Fish and Game, personal communication.

Whitten, K. 1999. Alaska Department of Fish and Game, personal communication, November 1, 1999.

Whitten, K.R. 1981. Game Management Unit 26B Central Arctic Herd. Pages 59-62 *in:* R.A. Hinman (ed.). Annual Report of Survey-inventory Activities. Part II. Caribou, Moose and Mountain Goats. Volume XII. Federal Aid in Wildlife Restoration Progress Report, Projects W-19-1 and W-19-2, Jobs 3.0, 1.0 and 12.0. Alaska Department of Fish and Game, Juneau, Alaska.

Whitten, K.R. 1988. Central Arctic Herd Caribou Survey-inventory Progress Report. Pages 71-73 *in:* S.O. Morgan (ed.). Annual Report of Survey-inventory Activities. Part XI. Vol XVII. Caribou. Federal Aid in Wildlife Restoration Progress Report, Project W-22-6, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Whitten, K.R., and R.D. Cameron. 1983a. Movements of Collared Caribou, *Rangifer tarandus*, in Relation to Petroleum development on the Arctic Slope of Alaska. *Canadian Field-Naturalist,* 97:143-146

Whitten, K.R., and R.D. Cameron. 1983b. Population Dynamics of the Central Arctic Herd, 1975-1981. *Acta Zool. Fenn.,* 175:159-161.

Whitten, K.R., and R.D. Cameron. 1985. Distribution of Calving Caribou in Relation to the Prudhoe Bay Oil Field. Pages 35-39 *in:* A.M. Martell and D.E. Russell (eds.). Caribou and Human Activity. Proceedings of the First North American Caribou Workshop. Canadian Wildlife Service Publication, Ottawa, Ontario, Canada.

Whitten, K.R., and R.D. Cameron. 1986. Groups Versus Individuals in the Determination of Caribou Distribution. *Rangifer,* Special Issue No. 1:325-329.

Wiens, J.A. 1995. Recovery of Seabirds Following the *Exxon Valdez* Oil Spill: An Overview. Pages 854-893 *in:* P.G. Wells, J.N. Butler, and J.S. Hughes (eds.). *Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Wiens, J.A. 1996. Oil, Seabirds, and Science: The Effects of the *Exxon Valdez* Oil Spill. *BioScience,* 46:587–597.

Wiens, J.A., T.O. Crift, R.H. Day, S.M. Murphy, and G.D. Hayward. 1996. Effects of the *Exxon Valdez* Oil Spill on Marine Bird Communities in Prince William Sound, Alaska. *Ecological Applications,* 6:828-841.

Wilkinson, P.F., C.C. Shank, and D.F. Penner. 1976. Muskox-caribou Summer Range Relations on Banks Island, NWT. *Journal of Wildlife Management,* 40:151-162.

Wilkinson, R.C., S.R. Johnson, and B.J. Gallaway. 1993. Application of GIS, CASI, and Habitat Suitability Models to Estimate Losses of Snow Goose Brood-Rearing Habitat. Report prepared by LGL Alaska Research Associates, Inc., for BP Exploration (Alaska) Inc., Anchorage, Alaska.

Williams, D. 2000. Alyeska Pipeline Service Company, personal communication, November 14, 2000.

Williams, T.M., G.A. Antonelis, and J. Balke. 1994. Health Evaluation, Rehabilitation, and Release of Oiled Harbor Seal Pups. Pages 227-241 *in:* T.R. Loughlin (ed.). Marine mammals and the *Exxon Valdez*. Academic Press, San Diego, California.

Willner, G.R., G.A. Feldhamer, E.E. Zucker, and J.A. Chapman. 1980. *Ondatra zibethicus*. Mammalian Species No. 141, American Society of Mammalogists.

Willson, W. 2000. Alyeska Pipeline Service Company, Environmental Department, Fairbanks, Alaska, personal communication, November 14, 2000.

Wilson, D.E., and D.M. Reeder. 1993. Mammal Species of the World. Smithsonian Institution Press, Washington, D.C.

Wilson, K.J., and D.R. Klein. 1991. The Characteristics of Muskox Late Winter Habitat in the Arctic National Wildlife Refuge, Alaska. *Rangifer,* 11:79-85.

Windsor, J. 1977. The Response of Peregrine Falcons (*Falco peregrinus*) to Aircraft and Human Disturbance. Unpublished report prepared by Canadian Wildlife Service. MacKenzie Valley Pipeline Investigations.

Winkler, W.J. 1975. Fox rabies. Pages 3-22 *in:* G.M. Baer (ed.). The Natural History of Rabies. Academic Press, New York.

Wiswar, D.W., and R.L. West. 1987. Fisheries Investigations on the Arctic National Wildlife Refuge, Alaska, 1984. Pages 778-800 *in:* G.W. Garner and P.E. Reynolds (eds.). Arctic National Wildlife Refuge Coastal Plain Resource Assessment: 1985 Update Report. U.S. Fish and Wildlife Service, Anchorage, Alaska

Wohlforth, C. 1991 Spill Suit Ended Inlet Case Nets State $700,000. Page B2 *in:* Anchorage Daily News, January 26, 1991.

Wolfe, R.J. 1983. Understanding Resource Uses in Alaskan Socioeconomic Systems in Resource Use and Socioeconomic Systems. R.J. Wolfe and L.J. Ellana, compilers. Technical Paper No. 61. Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska.

Wolfe, R.J. 1996. Subsistence Food Harvests in Rural Alaska and Food Safety Issues. Paper presented to the Institute of Medicine, National Academy of Sciences, Committee on Environmental Justice, Spokane, Washington, August 13, 1996.

Wolfe, R.J., and R.G. Bosworth. 1994. Subsistence in Alaska: 1994 Update. Alaska Department of Fish and Game, Division of Subsistence.

Wolfe, R.J., and R.J. Walker. 1987. Subsistence Economies in Alaska: Productivity, Geography, and Development Impacts. *Arctic Anthropology,* 24(2):56-81.

Wolfe, R.J., J.J. Gross, S.J. Langdon, J.M. Wright, G.K. Sherrod, L.J. Ellanna, V. Sumida, and P.J. Usher. 1984. Subsistence-based Economies in Coastal Communities of Southwest Alaska. Social and Economic Studies Program Technical Report No. 95. Prepared for the Alaska Department of Fish and Game, Division of Subsistence, Juneau and Minerals Management Service, Alaska Region, Anchorage, Alaska.

Wolfe, S.A., B. Griffith, and C.A.G. Wolfe. 2000. Response of Reindeer and Caribou to Human Activities. *Polar Research* 19:63-73.

Wolff, J.O. 1980. The Role of Habitat Patchiness in the Population Dynamics of Snowshoe Hares. *Ecological Monographs,* 50:111-130.

Woodby, D.A., and D.B. Botkin. 1993. Stock Sizes Prior to Commercial Whaling. Pages 387-407 *in:* J.J. Burns, J.J. Montague, and C.J. Cowles (eds.). The Bowhead Whale. Special Publication No. 2. The Society for Marine Mammology.

Woodward-Clyde Consultants. 1980. Gravel Removal Studies in Arctic and Subarctic Floodplains in Alaska. FWS/OBS-80/08. U.S. Fish and Wildlife Service, Washington, D.C.

Woodward-Clyde Consultants. 1983. Lisburne Development Area: 1983 Environmental Studies. Unpublished report for ARCO Alaska Inc., Anchorage, Alaska.

Woodward-Clyde Consultants. 1985. Lisburne Development Environmental Studies: 1984. Vol. 2. Caribou, Birds, and Oceanography. Final report prepared for ARCO Alaska Inc., Anchorage, Alaska.

Woolard, C., and S.T. Luetters. 1997. Starvation Response in Biological Treatment Systems. *in:* Proceedings of the Seventieth Annual Water Environment Federation Conference and Exposition. Chicago, Illinois.

Wooley, C. 1994. Cultural Resource Survey of Shorelines in Port Valdez, Alaska: Eastern Lion Oil Spill Response. Report to BP Exploration (Alaska) Inc. in partial fulfillment of State of Alaska Field Archaeology Permit 94–04. Report on file, Alaska Office of History and Archaeology.

Wooley, C. 1995. Alutiiq Culture Before and After the Exxon Valdez Oil Spill. *American Indian Culture and Research Journal,* 19(4). University of California, Los Angeles.

Wooley, C., S. Hillman, and D. O'Brien. 1997. Mapping Cultural Resource Sites for the Prince William Sound Graphical Resource Database. Proceedings of the Twentieth Arctic and Marine Oil Pollution (AMOP) Technical Seminar. Vancouver, British Columbia, Canada.

Woolington, J.D. 1997. Muskox Survey-inventory Progress Report 1994-1996, Game Management Units 26B and 26C. Pages 34-41 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities. Muskox. Federal Aid in Wildlife Restoration Progress Report, Projects W-24-3 and W-24-4, Study 16.0. Alaska Department of Fish and Game, Juneau, Alaska.

Woolington, J.D. 1997a. Game Management Units 20F, 21C, 21D and 24, Galena Mountain, Ray Mountains, and Wolf

Mountain Herds. Pages 148-157 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1994 – 30 June 1996. Caribou. Federal Aid in Wildlife Restoration Report, Grants W-24-3 and W-24-4, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Woolington, J.D. 1997b. Game Management Units 26B and 26C, Central Arctic Herd. Pages 219-233 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1994 – 30 June 1996. Caribou. Federal Aid in Wildlife Restoration Report, Grants W-24-3 and W-24-4, Study 3.0. Alaska Department of Fish and Game, Juneau, Alaska.

Woolington, J.D., and M.E. McNay. 1997. Game Management Unit 24, Koyukuk River Drainage. Pages 164-170 *in:* M.V. Hicks (ed.). Management Report of Survey-inventory Activities, 1 July 1993 – 30 June 1996. Federal Aid in Wildlife Restoration Report, Grants W-24-2 through W-24-4, Study 14.0. Alaska Department of Fish and Game, Juneau, Alaska.

Workman, W.B. 1976. Archaeological Investigations at GUL 077: A Prehistoric Site Near Gulkana, Alaska. Alaska Methodist University, Anchorage, Alaska.

Worl, R. 1978. Beaufort Sea Region Sociocultural Systems. Prepared for Peat, Marwick, Mitchell and Company for submission to the Bureau of Land Management. Technical Report 9, Alaska OCS Socioeconomic Studies Program. Bureau of Land Management, Alaska OCS Office.

Worl, R. 1979. Values of Subsistence to North Slope Inupiat Culture in Native Livelihood and Dependence: A Study of Land Use Values Through Time. North Slope Borough Contract Staff. National Petroleum Reserve in Alaska 105(c) Land Use Study Field Study 1. Bureau of Land Management, NPR–A Work Group 1, Anchorage, Alaska.

Worl, R. 1982. A Synopsis of Alaska Native Subsistence Economies and Projection of Research Needs. Bureau of Indian Affairs, Juneau Area Office.

World Oil. 1999. Industry Statistics - World Oil Production. *World Oil,* 220(12).

WRCC. 1999. Alaska Climate Summaries. Western Regional Climate Center.

Wright, J. 1999. Wildlife Biologist, Alaska Department of Fish and Game, personal communication, November 1, 1999.

Wright, J.W., and P.J. Bente. 1999. Documentation of Active Peregrine Falcon Nest Sites. Federal Aid in Wildlife Restoration Final Research Report, Grants SE-2-9, 10, 11. Alaska Department of Fish and Game, Division of Wildlife Conservation.

Yarborough, L.F. 1997. Site Specific Archaeological Restoration at SEW–440 and SEW 488. Exxon Valdez Oil Spill Restoration Project 95007B, Final Report. U.S. Forest Service, Chugach National Forest.

Yarborough, M.R., and L.F. Yarborough. 1996. Uqciuvit: A Multicomponent Site on Northwestern Prince William Sound. Final Site Report, Contract No. 53–0114–7–00132. Copies available from U.S. Forest Service, Chugach National Forest.

Yarie, J. 1981. Forest Fire Cycles and Life Tables: A Case Study from Interior Alaska. *Canadian Journal of Forest Research,* 11:554-562.

Yesner, D.R. 1994. Subsistence Diversity and Hunter-Gatherer Strategies in Late Pleistocene/Early Holocene Beringia: Evidence from the Broken Mammoth Site, Big Delta, Alaska. *Current Research in the Pleistocene,* 11:154–156.

Yesner, D.R. 1996. Human Adaptation at the Pleistocene-Holocene Boundary (Circa 13,000-8,000 BP) in Eastern Beringia. *In:* L.G. Strauss, B.V. Eriksen, J.M. Erlandson, and D.R. Yesner (eds.). Humans at the End of the Pleistocene-Early Holocene Transition. Plenum Press, New York, New York.

Yesner, D.R., C.E. Holmes, and K.J. Crossen. 1992. Archaeology and Paleoecology of the Broken Mammoth Site, Central Tanana Valley, Interior Alaska. *Current Research in the Pleistocene* 9:53-57.

Yokel, D. 1999. Bureau of Land Management, personal communication, November 1, 1999.

Young, D.D., and T.R. McCabe. 1998. Grizzly Bears and Calving Caribou: What is the Relation With River Corridors? *Journal of Wildlife Management,* 62:255-261.

Youngman, P.M. 1975. Mammals of the Yukon Territory. *Publications in Zoology*, No. 10. National Museums of Canada. 192 pp.

Zarnke, R.L., and W.B. Ballard. 1987. Serologic Survey for Selected Microbial Pathogens of Wolves in Alaska, 1975-1982. *Journal of Wildlife Diseases,* 23:77-85.

Zasada, J.C., B.J. Neiland, R. Densmore, M.A. Masters, and N. Moore. 1981. Investigations of Techniques for Large-Scale Reintroduction of Willows in Arctic Alaska. Prepared for Alyeska Pipeline Service Company, Anchorage, Alaska.

Zeh, J.E., J.C. George, and R. Suydam. 1994. Rate of Increase, 1978-1993, of Bowhead Whales, *Baleana mysticatus*. Report of the International Whaling Commission 45:339-344.

Zeh, J.E., A.E. Raftery, and A.A. Schaffner. 1996. Revised Estimates of the Bowhead Population Size and Rate of Increase. Report of the International Whaling Commission 46:670-696.

APPENDICES

Appendix A
Trans Alaska Pipeline System Throughput Analysis

by L.D. Maxim

Assumptions for future Trans Alaska Pipeline System (TAPS) throughput are needed for estimating environmental, economic, and social impacts (incremental and cumulative) of the proposed action. In turn, TAPS throughput depends on assumptions regarding the decline curves applicable to existing fields and the discovery of and production from new fields. Reasonable forecasts can be made for certain mature fields, but reserve additions, future discoveries, and production from new fields are speculative. Actual production depends on exploration and development decisions yet to be made and which will reflect crude oil prices, available technology, field economics, transportation costs, and regulatory actions in the future. Many of these factors, such as future oil prices or lease availability and access decisions, are extremely difficult to forecast.

For example, in the environmental evaluation document for the Alpine Development Project (USACE, 1997), 25 key steps necessary for project development are identified and have probabilistic outcomes. Despite extensive use of sophisticated mathematical models, estimates of economically recoverable resources for the National Petroleum Reserve-Alaska (NPR-A) (BLM and MMS, 1998) made by the Bureau of Land Management (BLM) ranged by more than a factor of four from approximately 500 million to 2,200 million barrels (bbl). New stratigraphic play concepts for the Jurassic system may lead to the discovery of fields overlooked by past exploration efforts, and advancements in technology have lowered the field-size threshold for commercial development. Government decisions to open new areas for exploration and production cannot be predicted with any certainty and are subject to political considerations. For this reason, a “bottom-up” field-by-field forecast is not likely to furnish a useful methodology and is certain to raise extraneous issues.

Since peaking at over 2 million bbl/day in 1988, North Slope oil production has declined at an average annual rate of 4.4 percent. While regularly produced projection forecasts of the Alaska Department of Revenue (ADOR) and the Alaska Department of Natural Resources (ADNR) have consistently proven to be reliable over the near term, they have proven to be conservative over the long term (USDOE, 1994). The reason for this is that the forecasts are based only on known producing fields and those under development. Figure A-1 shows successive annual ADNR throughput projections for the North Slope for the years beyond 1997. Successive projections have generally resulted in upward revisions of expected production in a given year, as well as postponement of the year at which production is expected to fall below a certain benchmark. For example, between 1985 and 1999, the projected production for 2010 has increased from 36 million to 256 million bbl/year — an increase from 0.1 to 0.702 million bbl/day. Also, between 1985 and 1999, the time when production is projected to first fall below 400,000 bbl/day has been extended from 2003 to 2017.

Recognizing that the ADOR and ADNR projections have historically been conservative and have required adjustment as time passes, this analysis adopts as its baseline throughput assumption the most recent U.S. Department of Energy projection (EIA, 1999e). The USDOE projection published in the *Annual Energy Outlook 2000* (which includes Cook Inlet production that is negligible in proportion) forecasts Alaska oil production to decline at a rate of 4.1 percent per year from 1997 through 2020. The reference-case (most-probable) production rates are as follows: 2010, 0.78 million bbl/day; 2015, 0.61 million bbl/day; and 2020, 0.49 million bbl/day (Table A-1).

The projection uses specific assumptions about oil price, the resource base, and technology to develop estimates of profitable investment in three onshore and three offshore regions in Alaska. The world oil price in 1998 dollars/bbl is assumed to rise to $21.00 in 2010 and $22.04 in 2020. The resource base assumptions are taken from the U.S. Geological Survey (USGS) and the Mineral Management Service (MMS) of the U.S. Department of the Interior, with supplemental adjustments to the USGS nonconventional resources by Advanced Resources International, an independent consulting firm. Technological improvements affecting recovery and cost are projected which increase drilling success rates and reduce the effective cost of sup-

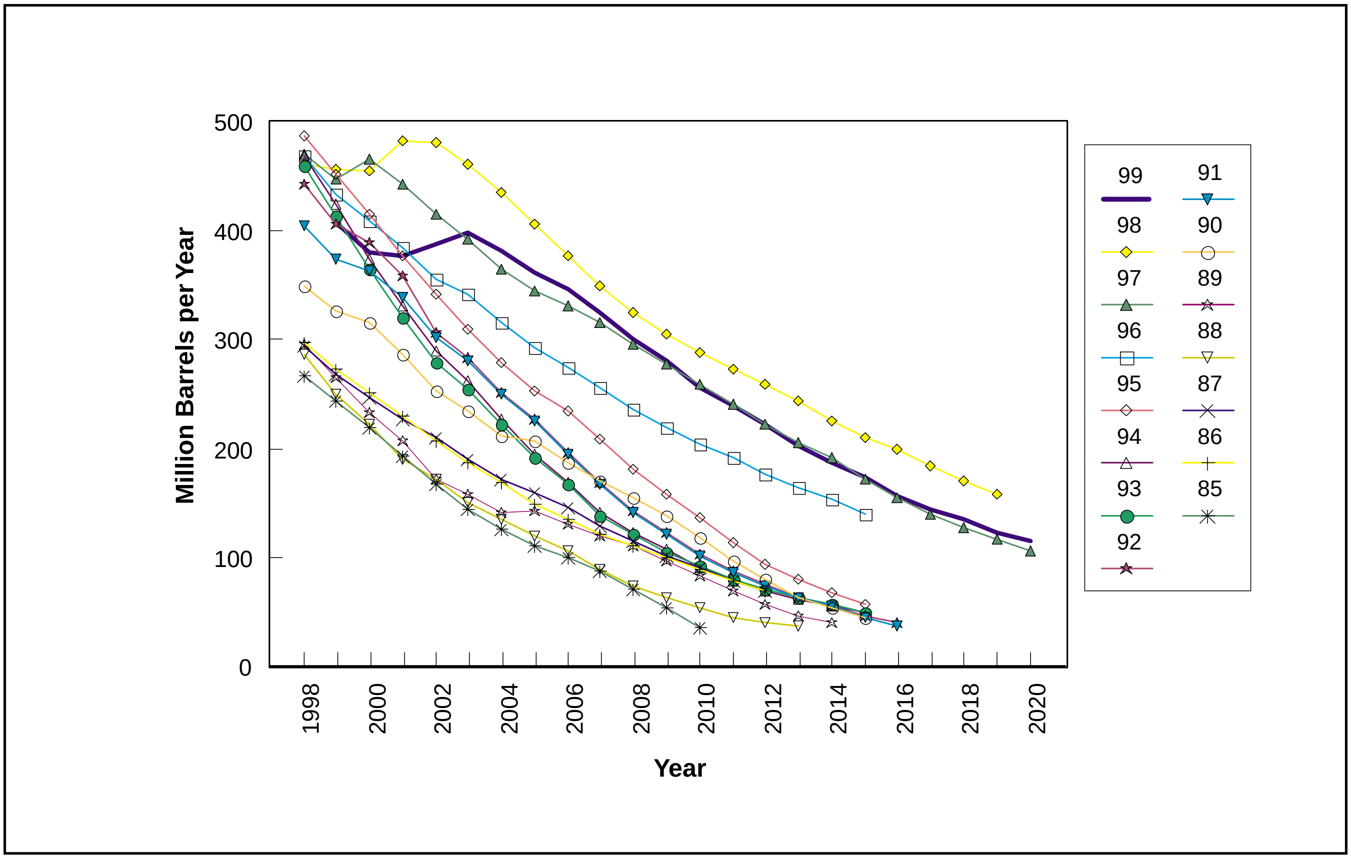


Figure A-1. *Alaska North Slope oil production projections by the Alaska Department of Natural Resources.*

Table A-1. *Baseline throughput assumption and constant decline model compared.*

Year	Baseline (million bbl/day)	Constant Decline Rate (million bbl/day)
2000	1.19	1.19
2002	1.10	1.10
2004	1.02	1.02
2006	0.93	0.93
2008	0.85	0.85
2010	0.78	0.78
2012	0.71	0.71
2014	0.64	0.64
2016	0.59	0.59
2018	0.54	0.54
2020	0.49	0.49
2022	0.49	0.45
2024	0.49	0.42
2026	0.49	0.38
2028	0.49	0.35
2030	0.49	0.33
2032	0.49	0.30

Source: USDOE (1998) and author's estimate.

ply over time. The USDOE forecast includes a provision for new fields, but assumes that current restrictions on leasing and drilling in Alaska, in particular the Arctic National Wildlife Refuge, will continue to be enforced for the duration of the forecast period.

Several alternative projections demonstrate the sensitivity of the USDOE projection of Alaska oil production to various assumptions regarding economic growth, world oil price, and the pace of technological progress. Based on USDOE's projected production in 2020 (Table A-2), there is little downside sensitivity to lower economic growth or world oil price. The projection is more sensitive to the rate of technological progress. USDOE created the technical progress cases by adjusting reference-case parameters which control the rates of change of finding rates, drilling, lease equipment and operating costs, and growth in the undiscovered economic resource base. The rates in the sensitivity cases were varied from their statistically estimated values by one standard deviation.

The baseline TAPS throughput assumption of 0.49 million bbl/day (from 2020) is higher than the spring 1999 ADOR projection (0.38 million bbl/day). However, it is significantly smaller than the "high-case production scenario,"

Table A-2. *Alaska oil production in 2020: Sensitivity results (million bbl/day.)*

Case	Production (million bbl/day)
Reference case	0.49
Low economic growth	0.49
High economic growth	0.50
Low world oil price	0.45
High world oil price	0.59
Slow technological progress	0.37
Rapid technological progress	0.66

Source: USDOE (1998).

which posits an additional 0.98 million bbl/day "technically recoverable" if prices were high enough (ADOR, 1999). At presently projected crude-oil prices, ADOR estimates that an additional 0.23 million bbl/day might be available. Thus, including additional fields, the ADOR estimate totals 0.61 million bbl/day, which is generally consistent with the baseline throughput assumption.

The USDOE projections have been stable in recent years. The *Annual Energy Outlook 1998* projected the Alaska production decline rate at 4.3 percent per year from 1996 to 2020. The 1997 Outlook projected the decline rate from 1995 to 2015 to be 4.2 percent.

In the baseline throughput case, it is assumed that throughput remains constant at 0.49 million bbl/day from 2020 until 2034 — the end of the 30-year TAPS ROW renewal period. This assumption is not a projection, but a recognition that a number of production scenarios are possible. For example, throughput profiles based on limited use of gas-to-liquids conversion for the Prudhoe Bay and Pt. Thomson gas fields are very nearly flat (INEEL, 1996). For comparison, production was also calculated (Table A-1) if the decline rate of 4.1 percent were to continue until 2034. In that case, production would be 0.28 million bbl/day in 2034. Figure A-2 shows the baseline throughput assumption. Over the 30 years from 2004 until 2034, total Alaska North Slope production is equal to approximately 7.02 billion bbl. For quantitative perspective, cumulative TAPS throughput from 1977 through 1998 was approximately 12.5 billion bbl (APSC, 1999).

For estimating the environmental impacts of renewal of the TAPS ROW, the most important consideration is that the production level be sufficient for continued operation of the pipeline. The environmental impacts are less sensitive to the particular level of pipeline throughput. Recent studies projecting when the TAPS pipeline might shut down have variously estimated that the minimum technically feasible sustainable TAPS throughput without modifications is in the range of 0.2 to 0.6 million bbl/day (INEEL, 1991, 1993, 1996; GAO, 1993). Below 0.6 million bbl/day, "mechanical revisions" may be required to operate with a throughput below that level. And operation at less than 0.3 million bbl/day "would require additional mechanical

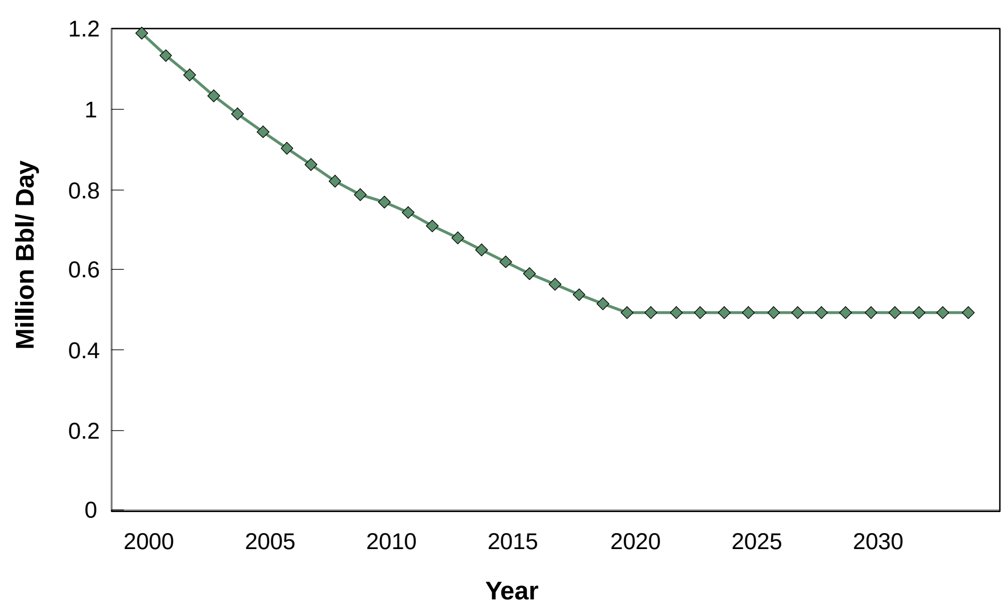


Figure A-2. *Baseline throughput assumption used in this analysis.*

modifications and would result in a greater decrease in the oil temperature in route to Valdez which would cause an increase in the oil viscosity and more wax problems. The increased formation of wax is the more critical and costly of these factors" (INEEL, 1991).

However, the minimum economically feasible throughput is less than this because it is likely that modifications will be made to permit operation at a lower throughput in order to avoid leaving economically recoverable oil stranded on the North Slope. The minimum economically feasible throughput level will be attained when the cost of continued operation, including the cost of modifications to handle reduced throughput, rises to a level that eliminates the profits from additional production on the North Slope. The studies mentioned above recognized the existence of this lower minimum economically feasible throughput but have not attempted to calculate that minimum. Such an analysis would require knowledge of the cost of pipeline operations, the characteristics of the liquid transported, and the cost of design modifications required as throughput declined — as well as other variables. The U.S. General Accounting Office (GAO) study suggested that "companies may be willing to incur the expensive changes required to continue operating TAPS at reduced levels if warranted by the overall profitability of the companies' Alaska operations" (GAO, 1993). The 1996 USDOE study (INEEL, 1996) notes that "it is a common belief by many parties in Alaska that . . . the lower limit will be reduced to 0.1 million bbl/day or less," although there are no known studies to confirm this.

References - Appendix A

ADOR. 1998. Revenue Sources - Fall. Alaska Department of Revenue.

ADOR. 1999. Incremental Revenue from High Case Forecast of: 1) New Discoveries of Oil and Gas, and 2) Development of Discovered Oil and Gas Not Currently Scheduled for Development. Alaska Department of Revenue.

APSC. 1999. Trans Alaska Pipeline System Facts. Alyeska Pipeline Service Company, Anchorage, Alaska.

BLM and MMS. 1998. Northeast National Petroleum Reserve-Alaska, Final Integrated Activity Plan/Environmental Impact Statement. Volumes 1 and 2. Prepared by U.S. Department of the Interior, Bureau of Land Management and Minerals Management Service, Alaska State Office. Government Printing Office, Washington, D.C.

EIA. 1999. Annual Energy Outlook 2000 with projections to 2020. Energy Information Administration, Washington, D.C.

GAO. 1993. Trans-Alaska Pipeline, Projections of Long-Term Viability Are Uncertain. U.S. General Accounting Office. GAO/RCED-93-69.

INEEL. 1991. Alaska Oil and Gas: Energy Wealth or Vanishing Opportunity? Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho. Prepared for U.S. Department of Energy, Office of Fossil Energy, Idaho Operations Office.

INEEL. 1993. Alaska North Slope National Energy Strategy Initiative: Analysis of Five Undeveloped Fields. Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho. Prepared for U.S. Department of Energy, Office of Fossil Energy, Idaho Operations Office.

INEEL. 1996. Economics of Alaska North Slope Gas Utilization Options. Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho. Prepared for U.S. Department of Energy, Office of Fossil Energy, Idaho Operations Office.

USACE. 1997. Alpine Development Project: Environmental Evaluation Document. U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

USDOE. 1994. Exporting Alaskan North Slope Crude Oil, Benefits and Costs. U.S. Department of Energy, Washington, DC.

USDOE. 1996. Annual Energy Outlook 1997 with Projections to 2015. U.S. Department of Energy, Office of Integrated Analysis and Forecasting, Washington, DC. DOE/EIA–0383(97).

Appendix B
Oil Spill Analysis for North Slope Oil Production and Transportation Operations

By IT Corporation staff, L.D. Maxim, and R.W. Niebo

B.1 Introduction

This appendix contains more detailed descriptions and supporting analyses of the oil spill data summarized in the conclusions and estimates presented in Section 4.1.2 of this environmental report. This appendix:

- Describes the oil spill database prepared by IT Corporation,
- Presents summary spill statistics by source and material spilled,
- Provides a statistical analysis of oil spill frequency and volume,
- Summarizes relevant time trends, and
- Develops probabilistic estimates of possible future oil spills associated with the continued operation of the Trans Alaska Pipeline System (TAPS) and related facilities from 2004 through 2034.

Because the statistical characteristics of oil spills differ among the various components of North Slope oil production and transportation Operations, separate spill projections are provided for each of the four segments:

- Alaska North Slope (ANS) exploration and production (E&P),
- The pipeline,
- The Valdez Marine Terminal (VMT), and
- The marine transportation (tanker) link.

Strictly speaking, neither the E&P operations nor the marine transportation system is part of TAPS[1], and environmental impacts of these operations should be treated in the discussion of cumulative effects. However, these are elements in the production and transportation system and are included for completeness.

As the term is used here, "oil spills" are unintentional, accidental releases of oil or other pollutants. Accidents are fundamentally probabilistic, rather than deterministic, events. Accordingly, it is appropriate to analyze accident data in statistical terms. Therefore, statistical methods are used in this appendix to analyze the frequency and volume of oil spills.

B.2 Oil Spill Data

The quality of any statistical analysis is critically dependent on the accuracy, completeness, and validity of the input data. Thus, it is appropriate to begin with a description of these data and the procedures used for editing and validation. For most environmental impact statements (EISs) designed to estimate impacts of a project still in the design stage, it is necessary to rely on surrogate spill data (e.g., Minerals Management Service [MMS] data on outer continental shelf [OCS] oil spills) that are presumed to be representative of expected spill experience for the project being analyzed. The original TAPS EIS, which was prepared by a special interagency task force for the Federal Task Force on Alaskan Oil Development (BLM, 1972, Vol. 1, p. 29), recognized this data problem and declined to develop quantitative estimates of pipeline spills from TAPS. Rather, it concluded that "the available record of accidental loss from liquid pipelines in the United States is not an adequate base for the prediction or modeling of spills that could occur as a result of the operation of the proposed trans-Alaska pipeline..."

Since spill data have been collected throughout the 22-year history of TAPS and it is not necessary to use surrogate data, the realism of the analysis is materially increased.

[1] Stipulation 1.1.1.22 of the Federal Grant (1974) defines "pipeline system" as "all facilities located in Alaska used by Permittees in connection with the construction, operation, maintenance or termination of the Pipeline. This includes, but is not limited to, the Pipeline, storage tanks, Access Roads, communications sites, airfields, construction camps, materials sites, bridges, construction equipment and facilities at the origin station and at the Valdez terminal. *This does not include facilities used in connection with production of oil or gathering systems, nor does it include such things as urban administrative offices and similar facilities which are only indirectly involved.*" [Emphasis added.] Note that aside from the VMT, there is no mention of tankers or destination ports in this definition.

Where noteworthy, other spill estimates are included for comparison with the statistics presented here.

Historical oil spill data are collected as part of the environmental stewardship activities of the companies engaged in the exploration, production, and shipment of ANS crude oil. Spill data are collected in conformity with federal, state, and local spill reporting requirements. In order to understand the types of spill information available, it is helpful to examine briefly the framework of these requirements. Spill reporting requirements applicable to Operations include federal and state regulations, as well as spill reporting obligations under the terms of the TAPS right-of-way (ROW) State Lease and Federal Grant.

The Clean Water Act of 1972 (CWA) provides the federal foundation for regulations detailing specific requirements for pollution prevention and response measures. Section 311 of the CWA addresses pollution from oil and hazardous substance releases, providing the U.S. Environmental Protection Agency (EPA) and the U.S. Coast Guard (USCG) with the authority to establish a program for preventing, preparing for, and responding to oil spills in navigable waters of the U.S. Provisions of the CWA are embodied in a variety of regulations, including the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the oil pollution prevention regulations.

The NCP is the federal government's blueprint for responding to oil spills and hazardous substance releases. The first NCP was developed and published in 1968 following the *Torrey Canyon* oil spill off the coast of England. The 1968 NCP provided the first comprehensive system of accident reporting, spill containment, and cleanup, and established a response headquarters, a national reaction team, and regional reaction teams (precursors to the current National Response Team and Regional Response Teams). Over the years, additional revisions were made to the NCP in accord with new legislation. The latest revisions were made final in 1994 to reflect the oil spill provisions of the Oil Pollution Act of 1990 (OPA 90). OPA 90 increased penalties for regulatory noncompliance, broadened the response and enforcement authorities of the federal government, and preserved state authority to establish laws governing oil spill prevention and response.

Under the NCP, the EPA and USCG established requirements to report spills to navigable waters or adjoining shorelines. EPA requires owners or operators of facilities that discharge oil in quantities that may be harmful to public health or welfare, or to the environment, to report the spill to the federal government. This requirement stems from the EPA "Discharge of Oil" regulation (40 CFR Part 110.3). Under this regulation, *reporting* oil spills to the federal government does not depend on the specific amount of oil spilled, but instead on the presence of a visible sheen, sludge, emulsion, or discoloration created by the spilled oil. Spills are required to be reported to the National Response Center, the federal government's centralized reporting center staffed 24 hours a day by USCG personnel. The NRC maintains all reports of hazardous substance releases and oil spills made to the federal government. The National Response Center records and maintains all reports in the Emergency Response Notification System computer database.

In addition to federal requirements, the State of Alaska requires operators to notify the Alaska Department of Environmental Conservation (ADEC) of the following types of releases:

- Immediately notify ADEC of any discharge or release of oil to water, or any discharge or release (including a cumulative discharge or release) of oil in excess of 55 gallons solely to land outside an impermeable secondary containment area or structure; and
- Notify ADEC within 48 hours after discovery (including a cumulative discharge) of oil discharged solely to land in excess of 10 gallons, but 55 gallons or less, or in excess of 55 gallons, if the discharge or release is the result of the escape or release of oil from its original storage tank, pipeline, or other immediate container into an impermeable secondary containment area or structure.

ADEC also requires all operators to maintain records and submit a monthly report of each discharge or release, including a cumulative discharge or release, of 1 to 10 gallons of oil solely to land.

A third type of spill reporting is required by the TAPS ROW agreements, which require Alyeska Pipeline Service Company to report spills that are required to be reported to other agencies, and to maintain records of for spills below reporting thresholds. This data set contains the most extensive information on spills throughout the history of TAPS operations.

B.3 Data Sources and Compilation

Historical spill records associated with Operations are assembled and analyzed to characterize spill frequency and volume, normalize data to relevant exposure metrics, assess possible time trends, and make projections of future spill frequencies and volumes. The occurrence of Operations spills may be a function of several factors, including pipeline throughput and the level and types of operations at

pipeline facilities and along the pipeline.

Data are analyzed separately for ANS E&P, the pipeline, the VMT, and the marine transportation link (tanker trade). As noted above, E&P and marine transportation spills are properly regarded as cumulative, rather than direct, effects of TAPS, but are included in this section for completeness.

B.3.1 Data Sources

IT Corporation compiled oil spill data from a number of databases, most of which are maintained to satisfy regulatory reporting requirements. The validity of the spill analysis is directly related to the accuracy and coverage of the data [see USCG (1997a) for a description and evaluation of several government data sources]. Quality spill data from the following reliable sources were sought for each segment of crude oil transportation:

- Alyeska spill database,
- ADEC database,
- U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety (OPS) database,
- Emergency Response Notification System database,
- USCG database,
- BP Exploration (Alaska) database,
- ARCO Alaska database, and
- North Slope crude oil shippers database.

(The word *database* is used in the singular form in this analysis. Some agencies maintain spill information in more than one database.)

Although all data sources are potentially useful and were consulted, the spills reported in each are not necessarily identical. This is true because of differences in reporting requirements for the segments of Operations, volume thresholds, whether or not all spills (e.g., including third-party spills) are included, and other reasons.

Alyeska has maintained spill data since 1974. Yearly variations in the types of information contained in the database reflect changes in regulatory reporting requirements, changes in operating practices, the incorporation of evolving knowledge about the quantitative characteristics of oil spills, and evolving environmental sensitivities.

For completeness and accuracy, IT Corporation compared Alyeska spill data with other agency-maintained data for consistency and coverage.

ADEC maintained a spills database in Fairbanks between 1971 and 1995. This database is commonly referred to as the "Fairbanks Data." The database contains records of reported spills from areas north of Tok, Alaska. ADEC now maintains a statewide spills database that records the reported spills of oil and hazardous substances in Alaska from mid-1994 to March 1999. The statewide database is considered more complete than the Fairbanks Data.

The OPS database (Little, 1999, pers. comm.), termed the Hazardous Liquid Pipeline Accident Database, includes pipeline spills that meet any of the following reporting criteria: (1) any spill volume greater than 50 bbl, (2) any spill resulting in personal injury, (3) any spill resulting in death, or (4) any spill resulting in an unintentional fire. The OPS database was downloaded via the Internet. Upon review, it was decided that Alyeska and ADEC data were more useful, in part because the higher threshold for recording in the OPS database led to the exclusion of potentially relevant spills. This choice does not reflect a judgment on the suitability of the OPS database for other analytical purposes.

The Emergency Response Notification System database is a compilation of notifications made to the federal government of releases of oil and hazardous substances. Data were downloaded from the system website, including data from 1987 to 1999. These data are not useful for this study because of the absence of accurate location data.

USCG data were obtained through the National Technical Information Services library. The data were located in the Marine Casualty and Pollution Database, part of USCG's Marine Safety Management System. These data were obtained to identify spills of ANS crude oil along tanker transport and delivery routes.

Spill data in electronic format from ARCO Alaska and BP Exploration (Alaska) were obtained and evaluated. These data were combined into a unified database to analyze spill data specific to the North Slope E&P activities.

Spill data were requested from the shipping companies of ANS crude. These data were used to identify spills occurring between Prince William Sound and the domestic delivery points. These data may be limited to spills within the waters of the United States. Table B-1 identifies the data sources used for the specific transportation segments.

Exploration and Production

Spill data associated with E&P activities, crude stabilization, and feeder pipelines available in electronic format were obtained from ARCO Alaska, Inc. and BP Exploration (Alaska) Inc. These data were compared with Alyeska data for redundancies and with the ADEC databases for completeness. Duplicate entries were eliminated and the resulting data included in the oil spill database.

Pipeline

A number of sources provide information on pipeline spills. The Alyeska data are judged to be the most accurate

Table B-1. *Operations spill data sources and data utilization.*

Data Source	E&P	Pipeline	Valdez Marine Terminal (VMT)	Tanker Trade
Alyeska Pipeline Service Company		√	√	
ADEC Statewide database	√	√	√	√
ADEC Fairbanks database	√	√	√	
Office of Pipeline Safety databases	√	√		
ERNS databases				√
United States Coast Guard databases				√
BP Exploration (Alaska) databases	√			
ARCO Alaska databases	√			
North Slope crude oil shippers database				√

and complete data for the pipeline. Data from the ADEC database were used to validate and supplement information contained in the Alyeska database. The ADEC database was also used to locate spills logically associated with TAPS operations but not contained in the Alyeska database. This does not reflect reporting errors in the Alyeska database. For example, Alyeska is not obligated to report third-party spills. However, the Alyeska database did contain *known* third-party spills which occurred in the vicinity of the pipeline. These included spills along the Dalton Highway and third-party spills that may have been reported by organizations other than Alyeska — such as trucking companies and tank-truck operators. Because these spills are logically related to TAPS operations, they have been added to the database. ADEC data from the statewide database also provided more detailed information regarding spill causes.

Few records from the other data sources could be correlated to specific locations along the pipeline. The Alyeska database was judged the most complete source of spill data and was supplemented as necessary with data from the ADEC database.

Valdez Marine Terminal

The Alyeska and the statewide ADEC databases were judged sufficiently complete for this analysis.

Marine Transportation Link

The two principal sources for the tanker-trade transportation segment are: Alyeska records of spills in Prince William Sound and the USCG database of reported spills into navigable waters of the United States.

Spill data from the ANS crude-oil shipping companies were used to identify spills between the VMT and the delivery points. These data were limited to spills within the waters of the United States and the U.S. Virgin Islands. In recent years, ANS crude has been exported to some destinations in the Orient, but the vast majority of TAPS throughput has been shipped to the United States, principally California, Washington state, Hawaii, and the U.S. Virgin Islands.

For completeness and accuracy, USCG spill data for vessels engaged in the ANS trade in all U.S. waters were included in the database. These data include spills of ANS crude occurring en route or in the vicinity of destination ports. For example, the 1985 spill from the grounding of the *ARCO Anchorage* near Port Angeles, Washington, is included in the spill database because this vessel was transporting ANS crude. As noted, inclusion of all marine transportation spills through the first destination port provides a more complete picture of spills associated with production and distribution of ANS oil. However, halting operation of this production-distribution link — a consequence of adopting the no-action alternative — would not eliminate all spills. Rather, crude oil imports would replace ANS production. These imports would be carried in tankers from foreign ports with attendant possibilities for spills en route and at destination ports.

B.3.2 Data Compilation

Data collected from the sources listed above were compiled into one master database by IT Corporation. Spills in this database include those occurring from the beginning of TAPS operations in 1977 through August 1999[2]. This is believed to be the most complete and accurate database available for Operations. Because of inclusion of additional

[2]Since August 1999, no large oil spills have been associated with TAPS; the last large (>1,000 bbl) spill occurred in 1990 (Table B-4). The oil spill analysis has not been updated to include small spills that may have occurred since August 1999. Since small spills account for only a minor portion of the total volume spilled over the life of TAPS, it is not useful to repeat the analysis after each small spill. These small spills have little or no material impact on the outcome of the analysis.

data, elimination of redundant information, and other data checks, the analyses based on these data may differ from those presented in other documents [such as Alpine (USACE, 1997), Beaufort Sea Sale 144 (MMS, 1996), NPR-A (BLM and MMS, 1998), and Northstar (USACE, 1999)].

Information fields unique to each individual source were preserved to the largest extent possible. Data fields were included to ensure that the data analysis would be consistent with available knowledge from the literature and/or prior analyses of oil spills. Table B-2 summarizes relevant propositions, hypotheses, and findings regarding oil spill

Table B-2. *Prior knowledge tested/incorporated in present spill analysis.*

Proposition	Source(s)	Implications for Analysis
Poisson process describes spill frequency distribution for spills in fixed size class.	Smith et al. (1982) also used as basis for all MMS EIS projections	Model reasonable, a priori, and supported by empirical data. Argues for retention of spill numbers as well as spill volumes.
Summary statistics to describe spill frequency must be chosen to reflect the shape of the probability distribution.	Smith et al. (1982)	Distribution of spill size should be examined and quantified.
Oil spills of different magnitudes have different damage potentials and may be expected to exhibit different statistical properties. Small spills are not usually a major concern.	Alpine EED (USACE, 1997) Beaufort Sea Sale 124 EIS (MMS, 1990) Beaufort Sea Sale 97 EIS (MMS, 1987a) Smith et al. (1982)	Analysis should focus on important spills. Larger spills are potentially more relevant.
Large spills occur relatively rarely, but account for a high proportion of the total amount spilled.	Beaufort Sea Sale 144 EIS (MMS, 1996) Chukchi Sea Sale 109 (MMS, 1987b) CONCAWE (1998) Northstar EIS (USACE, 1999) Smith et al. (1982)	Lorenz curves and empirical cumulative distribution functions (CDFs) should be plotted. Finding underscores the importance of volume data as well as number of spills.
It is reasonable to expect that spill occurrence rates will differ for the various modes of production and transport.	Amstutz and Samuels (1984) Smith et al. (1982) All ANS EISs	Separate spill analyses may be appropriate for various TAPS elements. Database should retain information on segments.
Spill forecasts should be keyed to an exposure variable such as volume of oil handled, pipeline length, port calls, number of tanker years, etc. Exposure variable should be simple and predictable in the future.	Beaufort Sea Sale 124 EIS (MMS, 1990) Beaufort Sea Sale 97 EIS (MMS, 1987a) CONCAWE (1998) Smith et al. (1982)	Spill forecasts should be keyed to reasonable exposure variable. Oil production/throughput is one reasonable basis for normalization. Past and projected system throughputs are important ancillary data.
Experience with Federal outer continental shelf may be a useful surrogate for Alaska.	Amstutz and Samuels (1984)	Hypothesis to be tested. ANS experience should be principal source of data.
ADEC database integrity as it pertains to ANS is most reliable for the period after 1989.	NPR-A EIS (BLM and MMS, 1998)	Estimates based upon post-1989 data may be preferable for analyses of ANS data. All data retained for this analysis.
Overall, there is no evidence to show that the aging of pipeline systems poses any greater level of risk.	CONCAWE (1998) based on analysis of European pipeline spill data.	Hypothesis to be tested. Predictions should be based upon actual ANS/TAPS experience.
Conclusions regarding spill performance may depend upon definitions of “spill” and volume cutoffs.	Observation based upon comparison of Alpine EED (USACE, 1997) and Northstar EIS (USACE, 1999).	Definitions should be made explicit. Comparisons among analyses should consider this factor.

frequencies and volumes from the literature. Though focused on implications for analysis, this material is also relevant to database design. For example, one of the findings reported in this table is that spill occurrence rates are likely to differ among the various modes of production and transport (e.g., Smith et al., 1982). Therefore, it is appropriate to include data fields describing the system element (i.e., stage in the production and transportation chain) associated with the oil spill to permit source-specific analyses. As a second example, larger spills are expected to account for the majority of the spilled volume — as shown by the data as discussed below — but no arbitrary spill threshold was imposed on the spill data included in the database. The operative principle is that any deletions should be keyed to the purposes and results of analysis, rather than determined a priori.

Spill data fields are included in the database to support the intended statistical analyses of the data. For example, because time trends are potentially important, it is necessary to retain information on the date of the spill.

Data are analyzed for each segment of the production and transportation system including North Slope E&P, the pipeline, the VMT, and the marine transportation link. Table B-3 summarizes the segments included, boundaries, spill locations, illustrative spill types, and data sources consulted in preparing the database. In fact, spill data are coded and can be retrieved by specific location and operation/equipment. For example, it is possible to identify all spills associated with a particular pump station, or facility (e.g., tank in tank farm), or individual piece of equipment (e.g., valve) associated with this pump station.

Although a natural focus of this analysis is crude oil spills, Operations include a number of materials that might also be spilled. For example, gasoline or other refined products are spilled in various transfer operations and as a result of valve or other failures at holding tanks, vehicle accidents, etc. Prior analyses have indicated that both spill frequency and volume vary with the material spilled. Therefore, it is appropriate to include fields that identify the various materials spilled. The database contains spill data for the following substances:

- Crude oil;
- Refined oil products ("product"), including aviation fuels, gasoline, diesel fuel, turbine fuel, motor oil, and lube oil;
- Other substances, including acetone, mercury, propane, antifreeze, Therminol, Halon, corrosion inhibitor, and "other" (undefined substances); and
- Water, including ballast water, oily water, and brine.

In accord with the spill analyses presented in recent environmental evaluation documents and EISs [e.g., all of the Beaufort Sea and Chukchi Sea EISs (MMS, 1987a, b, 1990, 1996)], this oil spill analysis focuses on crude spills, although data and analyses are presented for both crude and product spills.

Spill causes are potentially relevant for analysis. Therefore, reported spill causes are included in the database. Causes are categorized in the database as mechanical failure, operator error, corrosion, third-party activity, other, and unknown. Other information related to cause, source, and

Table B-3. *Operations segments employed in oil spill analysis.*

Segment	Segment Boundary	Where Spilled	Sample Major Spill Events	Principal Data Sources
ANS E&P	North Slope oil fields to Pump Station 1	North Slope oil wells, feeder pipelines (flowlines), and other ANS facilities	• Leaks on pads • Well workover/maintenance spills • Loading/unloading spills at crude oil topping units	BP/ARCO; ADEC
Pipeline	PS 1 to metering station at VMT	Distributed along length of pipeline, at pump stations, associated tanks farms, and access roads	• Steele Creek sabotage incident • Atigun Pass pipe settlement • Tank valve failure at PS 10 • Check Valve 92 failure	APSC; ADEC
VMT	Metering station to loading arm(s)	Within VMT	• Valve leak at East Tank Farm • Sump bleed line spill from fuel offloading rack	APSC; ADEC
Marine Transportation	Tankers	At loading dock, harbor, harbor approaches, and domestic destination ports (e.g., California, Hawaii, Washington state)	• *Thompson Pass* hull crack • *Exxon Valdez* grounding • Loading/unloading spills	APSC; ADEC; USCG

description of the spills is retained in the database.

Reports of recent spill events are typically more detailed than reports of older events. This may be due to changes in the regulatory reporting requirements, changes in the operations and procedures, advances in the technology and capability of spill detection, and the experience level of the reporting organizations. Increased requirements in OPA 90 are reflected in spill data after 1990.

B.3.3 Perspectives on Reliability, Accuracy, and Completeness

The spill data included in the database are believed to be both accurate and complete. The quality of the environmental stewardship activity, penalties for failure to report spills, and public sensitivity and scrutiny of Operations reduce the likelihood of reporting errors. Moreover, the systematic comparisons among data sets and inclusion of additional spill data (from third-party spills associated with Operations and tanker spills at destination ports) by IT Corporation contributed materially to the accuracy and completeness of the oil spill database used in this analysis. As noted above, the oil spill analyses are based on actual operating experience, rather than potentially imperfect surrogates.

Since volumes for some spills are estimated, rather than measured, error is introduced. Because some small spills are discovered after the fact and/or by indirect means (e.g., a stain on a pad or soils after snowmelt), it is possible that some spills were not detected and therefore not included in this database. However, it is very unlikely that an oil spill of appreciable volume would not be detected. Since small spills are not likely to have environmental significance and large spills account for nearly all the spilled volume, the effects of possible under-reporting are unlikely to be material. One analysis of Operations spill data (BLM and MMS, 1998) concluded that oil spill data are probably more reliable for the period after 1989 as a result of heightened public and regulatory agency concern following the *Exxon Valdez* oil spill (EVOS). Although not stated explicitly, the operative hypothesis is that data on post-1989 oil spills are less subject to reporting bias than are those that might have occurred earlier.

Finally, it is important to note that the number of spills and volumes shown in the accompanying figures and tables are for *all spills,* even though many of the spills did not reach the natural environment. Many of the reported spills (particularly smaller spills) occurred inside buildings, within secondary containment structures, or onto gravel pads and, therefore, were contained. Other spills occurred in winter months when the ground was frozen and were cleaned up before the spring breakup. These are potentially relevant (but unquantified) considerations in terms of assessing potential spill-related environmental impacts.

B.3.4 Ancillary Data

It was also necessary to collect some ancillary data such as on candidate *exposure variables.* As noted in Smith et al. (1982):

> Fundamental to the spill occurrence forecasting method is the notion of an exposure variable. An exposure variable is some quantity related to oil production or transportation, which has a precise statistical relationship to spill occurrence. In the past, the exposure variable used in the model has been volume of oil handled. Predicted probability distributions have been constructed by utilizing past rates of spills per volume of oil handled and the projected volume of oil to be handled.
>
> Other exposure variables could be used. In the case of tankers, for example, number of port calls and numbers of tanker years have been contemplated...

Figure B-1 shows the number of tankers loaded annually at VMT by year — one candidate exposure variable for the marine transportation link. These data are available from Alyeska. The volume of oil handled is another candidate exposure variable. TAPS throughput volumes are also available from Alyeska. As a practical matter, the number of tankers loaded is directly proportional to throughput for any assumed tanker fleet composition. As Figure B-2 shows, the number of tankers loaded and the volumes of crude shipped are highly correlated ($R^2 = 0.95$), indicating that the fleet size composition has not varied appreciably over the years. Based on the regression of tankers loaded on throughput volume, the average volume of oil carried per tanker over the years from 1977 to 1999 was 1/1.3 = 0.769 million bbl, or approximately 109,000 tons (figured at 7.07 bbl/ton). Figure B-3 shows a time trend of the average quantity of crude loaded per tanker by year from 1977 to 1999. As implied by the regression analysis shown in Figure B-2, this quantity has been relatively constant over the years. In the future, as tankers in the present fleet are phased out and replaced by double-hull tankers, this average may increase somewhat. (Three of ARCO's Millennium class tankers, carrying 125,000 tons, are on order and may serve as models for future new tanker construction for the ANS trade.)

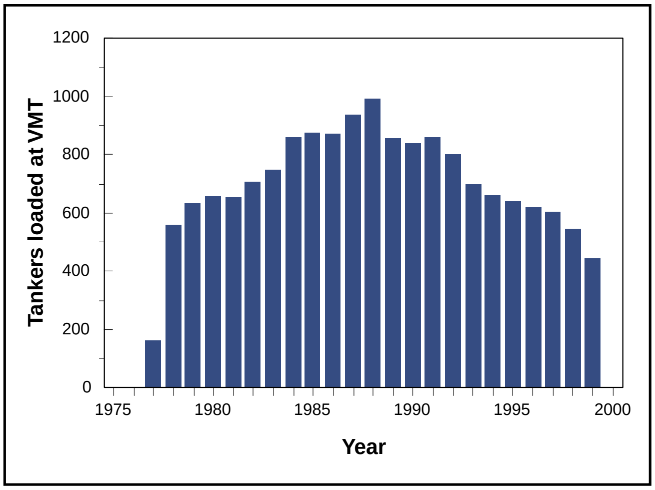


Figure B-1. Tankers loaded at VMT by year, 1977 to November 1, 1999.

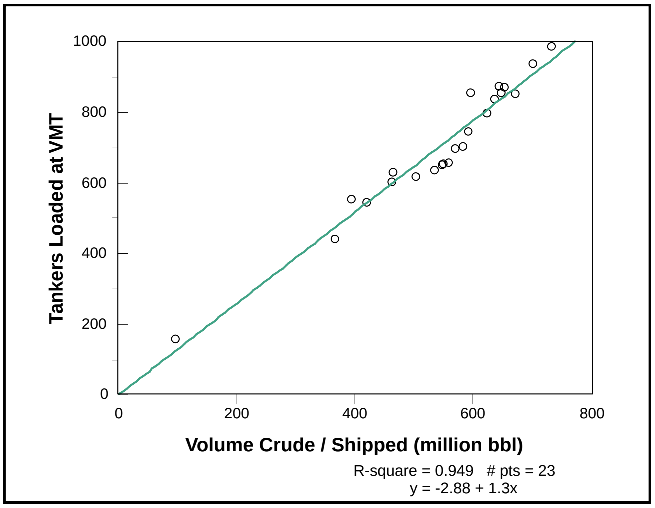


Figure B-2. Tankers loaded at VMT as a function of the volume of crude shipped, 1977 to 1999.

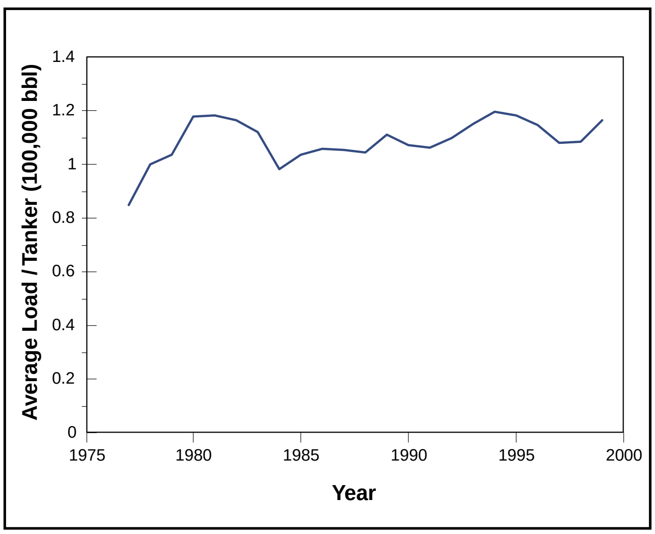


Figure B-3. Average load per tanker by year (1977 to 1999) for the ANS trade.

B.4 Summary Spill Statistics

This section highlights summary oil spill statistics, showing how spill frequency and volume vary with material spilled, Operations segment, and time. Although statistics on the number of spills are presented, the environmental consequences of oil spills are likely to depend more on the volume than the number of oil spills. Moreover, a few relatively rare spills account for the vast majority of the spill volume, which underlies the analytical focus of various government agencies (e.g., MMS) on larger spills. The analyses presented in this and later sections reflect the available knowledge and hypotheses distilled from the available literature summarized in Table B-2.

B.4.1 Spill Totals by Segment

For all Operations segments, approximately 10,600 spills occurred, for a total volume of approximately 327,100 bbl of either crude oil or products from 1977 until August 1999. This is equivalent to 480 spills/year, with an annual spill volume (crude and product) of 14,870 bbl.

The total spill volume is dominated by a single catastrophic event, the EVOS, which accounts for approximately 257,100 bbl or 78.6 percent of the total volume of crude and product spilled. The annual average is likewise dominated by the contribution of the EVOS. The annual average was exceeded in only two years out of TAPS 22-year history, 1989 (the year of EVOS) and 1978, when a single incident of sabotage to the pipeline at Steele Creek resulted in a spill of approximately 16,000 bbl.

The aggregate quantity spilled is certainly substantial, but accounted for only a small proportion of the system throughput throughout its 22-year history. From 1977 to 1999, TAPS throughput totaled nearly 13 billion bbl, so the total volumetric spill rate (including EVOS) over this period was approximately 25.6 bbl per million bbl throughput. (Excluding EVOS, the volume of crude and product spilled was 5.48 bbl/million bbl throughput. This was distributed among the various segments as follows; E&P, 0.86; pipeline, 2.45; VMT, 0.323; and the marine transportation link, 1.85.)

B.4.2 Statistics on Large Oil Spills

Perhaps the most striking feature of the Operations oil spill data is the relative importance of large oil spills. Table B-4 shows summary information about the ten largest oil spills (including both crude and product spills) over the operating history of TAPS. Several features of this table are

noteworthy:

- Collectively, these spills account for a very large percentage of the total volume of oil spilled. The “top ten” range in size from 1,700 to 257,143 bbl and account for approximately 93.5 percent of the total volume spilled. As noted above, there were a total of approximately 10,600 recorded spills over the period from 1977 to 1999. Thus, only 10 of a total of 10,600 spills (0.094 percent) accounted for 93.5 percent of the spill volume.
- If the large-spill threshold were set at 1,000 bbl (as is typical in MMS analyses), the number of large TAPS spills would increase to 11 (as a result of inclusion of a 1979 pipeline spill of 1,500 bbl at Atigun Pass) and would account for 94 percent of the total volume of oil spilled. These statistics clearly justify an analytical focus on large spills.
- Five of the largest 10 spills occurred on the marine transportation segment. There were four large pipeline spills and one large VMT spill. E&P spills, though most numerous, accounted for only 3.4 percent of the total spill volume.
- Of the marine transportation spills, the EVOS and *Thompson Pass* spills were unique to TAPS opera-

Table B-4. *The ten largest oil spills (1977 to 1999).*

Rank Event	Date Material Spilled	Quantity Spilled (bbl)	Material Spilled	Operations Segment	Description
Exxon Valdez	March 24, 1989	257,143	Crude oil	Marine	Tanker went aground on Bligh Reef, Prince William Sound
Steele Creek, MP 457.53	February 15, 1978	16,000	Crude oil	Pipeline	Leak caused by sabotage
American Trader	February 7, 1990	9,458	Crude oil	Marine	Vessel grounded on own anchor during mooring at Golden West Marine Terminal off Huntington Beach, CA.
ARCO Anchorage	December 21, 1985	5,690	Crude oil	Marine	Tanker ran aground in Port Angeles, WA
Glacier Bay	July 2, 1987	4,942	Crude oil	Marine	Tanker struck uncharted rock and went aground in Cook Inlet
MP 734	June 15, 1979	4,000	Crude oil	Pipeline	Pipe wrinkled and cracked due to settlement
VMT East Tank Farm	February 11, 1980	3,200	Crude oil	VMT	Leaking valve, East Tank Farm
Check Valve 23	January 1, 1981	2,000[a]	Crude oil	Pipeline	Leak due to drain connection failure
Check Valve 7	July 19, 1977	1,800	Crude oil	Pipeline	Front-end loader accidentally broke check valve
Thompson Pass	January 3, 1989	1,700	Crude oil	Marine	Crack in tanker hull at Valdez, AK
		Cumulative volume of ten largest crude or product spills			305,933 bbl
		Total volume of crude and product spilled			327,107 bbl
		Cumulative volume of ten largest crude or product spills as percent of total spilled			93.5 percent

Note: The TAPS oil spill database lists 11 spills larger than 1,000 bbl. These spills include the 10 listed above and the spill listed below:

Rank Event	Date Material Spilled	Quantity Spilled (bbl)	Material Spilled	Operations Segment	Description
Milepost 166.433 Atigun Pass	June 10, 1979	1,500	Crude oil	Pipeline	Pipeline support loss
		Cumulative volume of 11 largest crude or product spills			307,433 bbl
		Total volume of crude and product spilled			327,107 bbl
		Cumulative volume of 11 largest crude or product spills as percent of total spilled			94.0 percent

(a) According to JPO records. Spill volume is 1,500 bbl in Alyeska records. The larger volume is used in this analysis.
Source: Operations oil spill database compiled by IT Corporation, Inc. (1999).

tions. The *American Trader, ARCO Anchorage,* and *Glacier Bay* spills occurred at destination ports. The likelihood of oil spills at destination ports is proportional to the volume of oil imported, not to TAPS throughput. Even if TAPS were not in operation, import-related spills would still occur. It cannot be said that these three specific spills would have occurred were TAPS not in operation, but as long as oil is being handled, there is the statistical chance of oil spills.

B.4.3 Historical Aside: Comparison of Spill Volume Total with Original Estimates

The original TAPS EIS did not consider oil spills associated with ANS exploration and production activities and did not develop a quantitative estimate of pipeline spills, although it noted that spills were likely. Instead, marine transportation spills were the sole focus of study, and several estimates of spill volumes were presented.

Two bounding estimates are given in Volume 4 of the EIS (BLM, 1972, p. 484). These were intended to bracket probable spill rates and ranged from 402 bbl/day to 929 bbl/day assuming that the pipeline was operating at or near its maximum throughput of 2 million bbl/day. (The majority of the spill total was estimated based on an analysis of worldwide casualty losses. Ballast water treatment discharges were included in this total, but accounted for only 13 to 26 bbl/day.) Table B-5 reconstructs these estimates, making adjustments for possible spills at West Coast ports (most of which are included in the database) and for variable levels of TAPS output over the years — assuming (as in the original analysis) that spill volumes are directly proportional to throughput. Adding the estimated annual spill volumes for each year, the lower and upper bounds on estimated spills for the marine transportation link over the period from 1977 until 1999 are 2.56 million bbl and 5.91 million bbl, respectively.

At another place in the original EIS (BLM, 1972, Volume 1 Summary Sheet), it is stated that in an "average year" marine spills would be expected to be 140,000 bbl, equal to a total of slightly more than 3 million bbl over a 22-year period.

In fact, considering Operations spills from *all segments* (not just marine transportation), the actual spill volume total was 0.33 million bbl, lower than the lower bound by a factor of 7.7 and the upper bound by a factor of nearly 18.

Thus, actual Operations spill performance (large spills notwithstanding) was substantially better than expected when the system was constructed. (More recent benchmarks are included below.)

B.4.4 Number and Volume of Spill by Operations Segment

The number and volume of spills vary with material spilled and Operations segment. Figure B-4 shows the distribution of the *volume of crude and product spilled* for E&P, the pipeline, VMT, and marine transportation link. Figure B-5 shows the comparable distribution of the *number of crude and product spills* over the same period. The respective shares of total spill volume (and spill numbers shown in parentheses), including both crude and product, of the various system elements are; E&P, 3.36 percent (50.87 percent); pipeline, 9.56 percent (29.94 percent); VMT 1.26 percent (11.16 percent); and the marine transportation link (reflecting the contribution of EVOS), 85.82 percent (8.04 percent). Product spills are more numerous

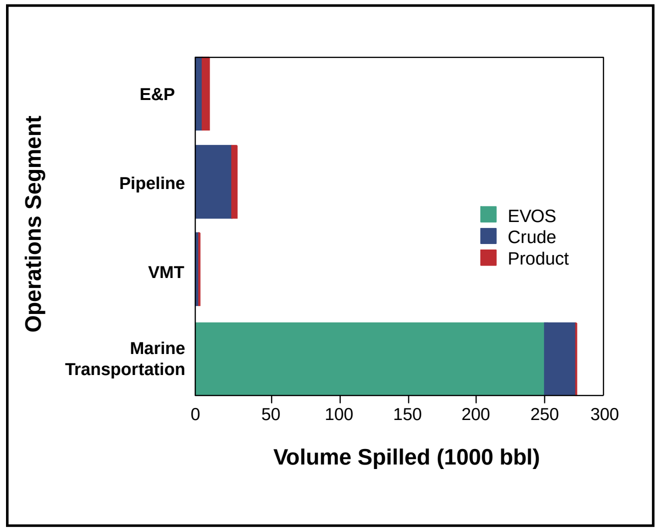


Figure B-4. *Distribution of total spill volume among segments for both crude and product spills (1977-1999).*

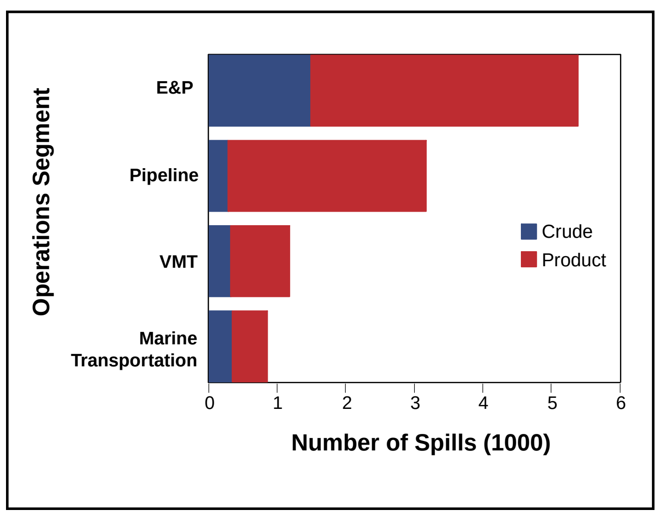


Figure B-5. *Distribution of total number of spills among segments for both crude and product spills (1977-1999).*

Table B-5. *More exact calculation of original EIS estimates of spill volumes. The planning-basis TAPS throughput assumed in EIS is 2 million bbl/day, or 730 million bbl/year.*

							Actual		
	EIS Predictions At Full Capacity		Less Amount Spilled At West Coast Harbors		Net Amount Spilled In Alaska and High Seas		TAPS Annual	Throughput Adjusted EIS Annual Projection	
Year	**Lower (bbl/day)**	**Upper (bbl/day)**	**Lower (bbl/day)**	**Upper (bbl/day)**	**Lower (bbl/day)**	**Upper (bbl/day)**	**Throughput (million bbl)**	**Lower (1000 bbl)**	**Upper (1000 bbl)**
1977	402	929	1.05	2.25	400.95	926.75	112.30	12.51	52.04
1978	402	929	1.05	2.25	400.95	926.75	397.01	79.59	183.96
1979	402	929	1.05	2.25	400.95	926.75	467.78	93.78	216.76
1980	402	929	1.05	2.25	400.95	926.75	554.93	111.25	257.14
1981	402	929	1.05	2.25	400.95	926.75	556.07	111.48	257.67
1982	402	929	1.05	2.25	400.95	926.75	591.14	118.51	273.92
1983	402	929	1.05	2.25	400.95	926.75	600.86	120.46	278.42
1984	402	929	1.05	2.25	400.95	926.75	608.84	122.06	282.12
1985	402	929	1.05	2.25	400.95	926.75	649.89	130.29	301.14
1986	402	929	1.05	2.25	400.95	926.75	665.43	133.40	308.35
1987	402	929	1.05	2.25	400.95	926.75	716.66	143.67	332.08
1988	402	929	1.05	2.25	400.95	926.75	744.11	149.18	344.80
1989	402	929	1.05	2.25	400.95	926.75	688.06	137.94	318.83
1990	402	929	1.05	2.25	400.95	926.75	654.55	131.22	303.30
1991	402	929	1.05	2.25	400.95	926.75	665.17	133.35	308.23
1992	402	929	1.05	2.25	400.95	926.75	639.36	128.18	296.26
1993	402	929	1.05	2.25	400.95	926.75	591.22	118.53	273.96
1994	402	929	1.05	2.25	400.95	926.75	579.32	116.14	268.44
1995	402	929	1.05	2.25	400.95	926.75	555.94	111.45	257.61
1996	402	929	1.05	2.25	400.95	926.75	525.51	105.35	243.51
1997	402	929	1.05	2.25	400.95	926.75	487.09	97.65	225.71
1998	402	929	1.05	2.25	400.95	926.75	440.50	88.31	204.12
1999	402	929	1.05	2.25	400.95	926.75	267.00	53.53	123.72
Total							12,758.7	2,557.8	5,912.1
Source/ Basis	BLM (1972) Vol. 4, Table 26, p 484, for Case II	BLM (1972) Vol. 4, Table 26 p 484, for Case IV	BLM (1972) Vol. 4 Table 26 Line 6 less Valdez	BLM (1972) Vol. 4, Table 26 Line 5 less Valdez	Subtraction Column 4 from Column 2	Subtraction Column 5 from Column 3	APSC (1999a) for 1977-1998, 1999 estimated.	Calculation prorated on output keyed to lower est. and converted to 365 days	Calculation prorated on output keyed to upper est. and converted to 365 days

Note: 1999 throughput estimate is through August 1999.

(77.1 percent of the total number of spills) but, because these typically involve smaller spills (see below), these account for only a small fraction (3.21 percent) of the spilled volume.

The dominance of a single event complicates the statistical analysis of the data. The EVOS spill is so large that it is appropriate to evaluate the likelihood of a recurrence of such an event as a separate meta-statistical question. A special section addressing marine transportation spills is included following the statistical analysis.

B.4.5 Contribution of Larger Spills (Lorenz Diagrams)

As noted above, a key conclusion of this analysis is that smaller spills (though more numerous) account for only a small proportion of the total spill volume. This is best shown by a *Lorenz diagram*, which displays the fraction of the spilled volume versus the fraction of the number of spills. (Lorenz diagrams were first developed by economists studying the distribution of incomes or wealth of various populations (see, e.g., Baumol, 1982; Samuelson, 1980; or Aitchison and Brown, 1969). This concept has also been applied to geographic (see, e.g., King, 1969) and mineralogical data (see, e.g., Koch and Link, 1971), and (without attribution) to oil spill data (CONCAWE, 1998.))

A Lorenz diagram is constructed as follows. First, the spill data are sorted in ascending order of spill volume. Next, the cumulative fraction of the volume spilled (y-axis) is plotted as a function of the cumulative fraction of the number of spills (x-axis). Figure B-6 provides a hypothetical illustration of a Lorenz plot. If all spills are exactly the same size, the fraction of the spill volume will correspond exactly to the fraction of the number of spills. The 45º line “AB” in Figure B-6 depicts this situation. If some spills are larger than others (as is to be expected from experience and the literature summarized in Table B-2), then the fraction of the spilled volume will be less than the fraction of the number of spills, as shown by the curve “AB” beneath the 45º line in Figure B-6. The area between the curve and the straight line (the shaded area in Figure B-6) provides an indication of the degree of inequality in spill size distribution. Dividing the shaded area by the area of the triangle (“ABC”) provides a normalized index or coefficient, denoted L, of the variability in spill volumes. L ranges from 0 (all spills the same size) to 1.

The Lorenz diagram shown in Figure B-6 is hypothetical, included solely to illustrate the concept. The actual Lorenz curves for Operations components are more extreme. Figure B-7 shows Lorenz plots for crude and product spills that occurred as a result of E&P activities from 1977 to 1999. As can be seen, there is very substantial curvature in these plots (the computed Lorenz coefficients are 0.911 and 0.883 for crude and product, respectively).

The Lorenz plots provide an important characterization of E&P (and, as shown below, for other Operations segments) spills. The clear message is that a few relatively large spills account for the majority of the spill volume. Most spills are relatively small. For E&P spills:

- Fifty percent (the median) of crude spills were less than or equal to 0.238 bbl (slightly less than 10 gal). Fifty percent of product spills were less than or equal to 0.119 bbl (slightly less than 5 gal).
- The smallest 90 percent of crude spills accounted for approximately 13 percent of the total volume spilled in this segment and the smallest 95 percent of the spills accounted for approximately 20 percent of the spilled volume. The corresponding percentages for product spills were 16 percent and 25 percent, respectively.
- Another perspective on spill volumes is provided by the cumulative distribution function (CDF). Figure B-8 shows the CDF for E&P spills (crude and product) over the period from 1977 to 1999. The CDF plots the fraction of spills with a volume less than or equal to a specified value V (on the y-axis) against the value of V (on the x-axis); crude spills are shown in green, product spills in red. Because of the large variability in spill volumes, only a portion of the CDF is plotted in Figure B-8; that for spills less than or equal to 2 bbl. The picture presented in Figure B-8 clearly shows that most spills are of relatively small volume. For E&P spills, 84.1 percent of crude spills and 92.2 percent of product spills are less than 2 bbl. Small spills (many measured in teaspoons) are quite diverse (fueling vehicles, leaking drums, splashes, etc.).

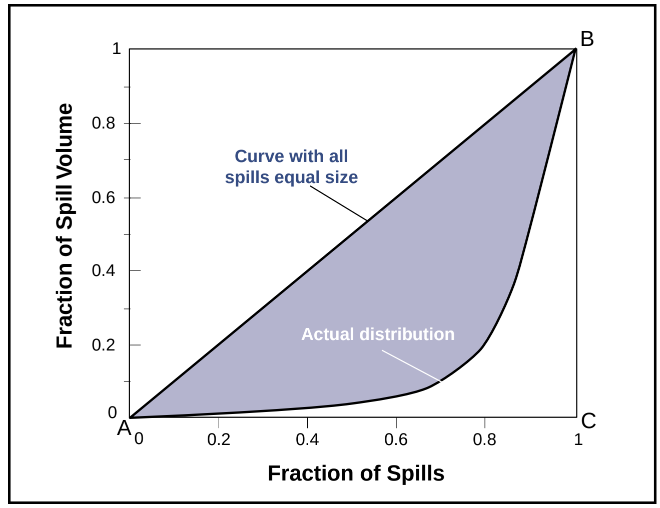


Figure B-6. *A hypothetical Lorenz diagram: the size of the area between the line of perfect quality and the Lorenz curve as a fraction of the bounding triangle is used as a measure of inequality.*

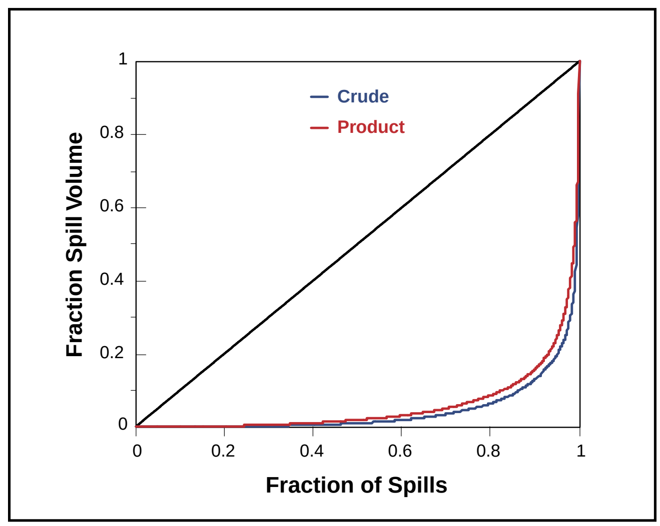


Figure B-7. *Lorenz curve for E&P spills (1977–1999).*

Spills along other segments of Operations have similar characteristics. For example, Figure B-9 shows Lorenz curves for pipeline crude and product spills over the same time period. Here the curves are even more “bowed,” a visual impression reflected in the computed Lorenz coefficients (0.986 and 0.945 for crude and product spills, respectively).

For pipeline spills:

- Fifty percent (the median) of crude spills were less than or equal to 0.0476 bbl (2 gal). The median product spill was 0.071 bbl (3 gal).
- The smallest 90 percent of crude spills accounted for approximately 0.25 percent of the total crude volume spilled in this segment and the smallest 95 percent of the spills accounted for 0.8 percent of the volume spilled. The corresponding percentages for pipeline product spills were 6.2 and 9.3 percent, respectively.
- Figure B-10 shows the CDFs for pipeline spills (crude and product) less than 2 bbl over the period from 1977 to 1999. These CDF resembles those for E&P spills. For pipeline spills, 88.0 percent of crude spills and 96.3 percent of product spills are less than 2 bbl.

VMT spills can be characterized in this same way as follows:

- Fifty percent (the median) of VMT crude spills were less than or equal to 0.0238 bbl (1 gal). The median product spill was 0.00595 bbl (0.25 gal).
- The smallest 90 percent of VMT crude spills accounted for approximately 0.81 percent of the total crude volume spilled in this segment and the smallest 95 percent of the spills accounted for 1.38 percent of the volume spilled. The corresponding percentages for VMT product spills were 4.2 and 8.2 percent, respectively.
- Figure B-11 shows the CDFs for VMT spills (crude and product) over the period from 1977 to 1999. For VMT spills, 95.3 percent of crude spills and 97.4 percent of product spills are less than 2 bbl.

Despite the large total volume of marine transportation spills, similar results are found for this segment:

- Fifty percent (the median) of marine crude spills were less than or equal to 0.0476 bbl (2 gal). The median product spill was 0.006 bbl (0.25 gal).
- The smallest 90 percent of marine crude spills accounted for only 0.03 percent of the total crude volume spilled in this segment and the smallest 95 percent of the spills accounted for 0.07 percent of the volume spilled. The corresponding percentages for marine product spills were 0.87 percent and 2.17 per-

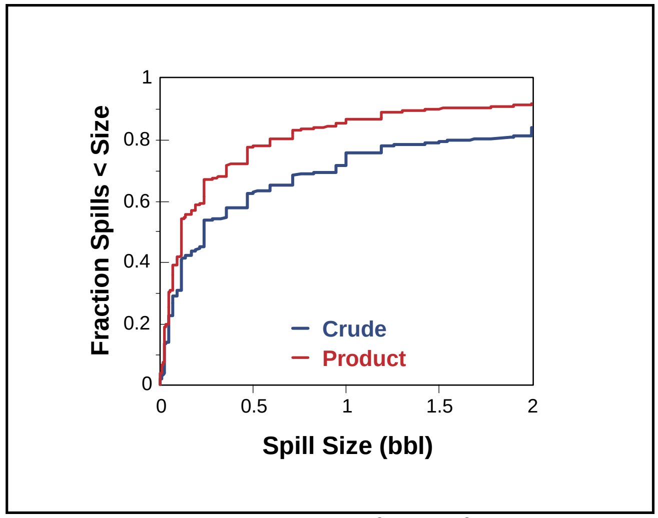


Figure B-8. *Cumulative distribution function for ANS E&P spills less than 2 bbl (1977-1999).*

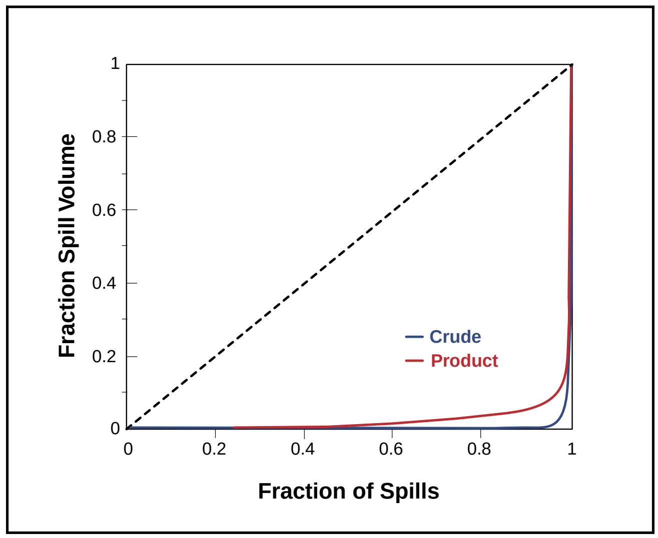


Figure B-9. *Lorenz curve for pipeline spills (1977–1999).*

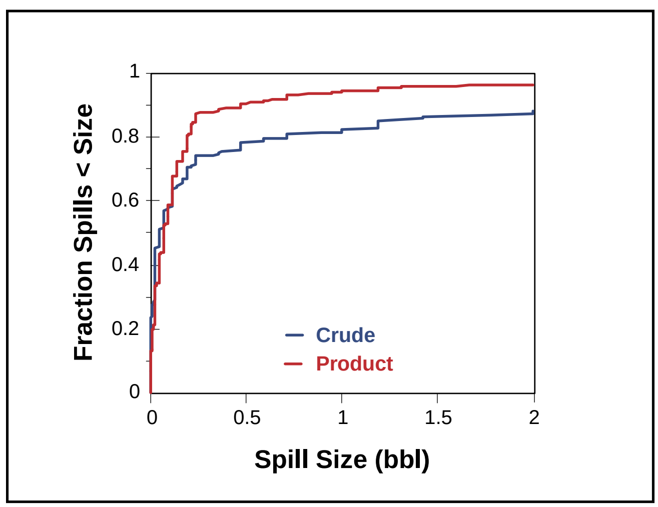


Figure B-10. *Cumulative distribution function for pipeline spills less than 2 bbl (1977-1999).*

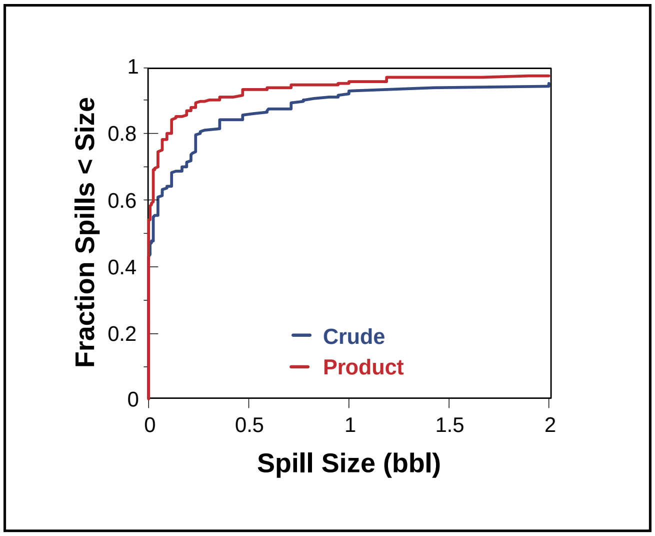


Figure B-11. *Cumulative distribution function for VMT spills less than 2 bbl (1977-1999).*

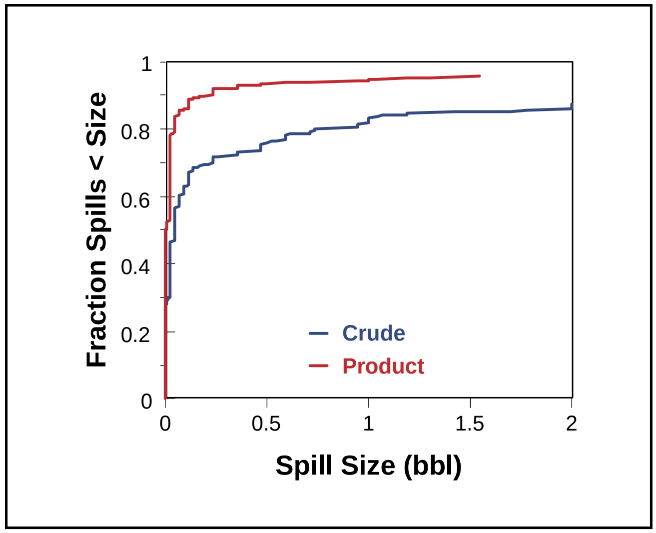


Figure B-12. *Cumulative distribution function for tanker spills less than 2 bbl (1977-1999).*

cent, respectively.

- Figure B-12 shows the CDFs for marine transportation spills (crude and product) over the period from 1977 to 1999. For marine transportation spills, 87.2 percent of crude spills and 95.4 percent of product spills are less than 2 bbl. Leaks in hoses, valves, and other minor operational problems are illustrations of small spills.

In this regard, Operations spill characteristics are similar to those that occur with other oil production and transportation systems (see Table B-2 for literature references). Small spills are inherently of less concern than larger spills for the following reasons:

- Small spills are more likely to be contained on site.
- Small spills have a lower potential to produce significant adverse environmental impacts.
- Small spills collectively (see Table B-2 and above) account for only a small proportion of the total volume spilled. Thus, any prediction bias introduced by an exclusive focus on large spills is small.

For these (and other reasons) the spill prediction methodology employed by the government concentrates on large spills, typically spills greater than 1,000 bbl or 100,000 bbl [see EISs for Beaufort Sea Planning Area Lease Sale 124 (MMS, 1990) and Lease Sale 97 (MMS, 1987a)]. Although this methodology is applicable in principle to Operations, a smaller threshold is necessary because very few “megaspills” have been observed. The largest observed spills for Operations are as follows: E&P, 925 bbl; pipeline, 16,000 bbl; VMT, 32,100 bbl; and marine transportation, 257,143 bbl.

Table B-6 shows the number of spills that exceeds a stated threshold size (e.g., >1,000 bbl) by Operations segment over the period from 1977 to 1999. The MMS methodology is based on the mean number of large spills per billion bbl throughput. To use this methodology for all segments of Operations (based on actual data) would require that the size threshold be no greater than 750 bbl, otherwise the estimated mean number of spills for E&P operations will be zero (a point explored below). However, it is interesting to take the data as given and compare large spill frequencies with those based on outer-continental-shelf and other experience.

These computations are also shown in Table B-6. The empirical large spill rate, expressed as the observed number of spills >1,000 bbl per billion bbl of throughput, is calculated for each of the segments and compared with the most recent MMS estimates (Anderson and LaBelle, 1994). Excluding E&P operations (which cannot be estimated because there have been no spills >1,000 bbl), the empirical spill rates for Operations compare favorably with MMS experience. For example, pooling pipeline and VMT spills results in a spill rate of 0.47 large spills per billion bbl.

This rate is only about 36 percent of the rate (1.32) based on MMS analysis of outer-continental-shelf data — that is; Operations experienced 65 percent fewer large pipeline and terminal spills than would be expected. We are unable to determine whether or not terminal spills were included in the MMS rate of 1.32 large spills/billion bbl throughput for pipelines shown in Table B-6. The data presented in the paper on which the analysis is based (Anderson and LaBelle, 1994) do not include any terminal spills, which may mean that no large spills occurred or that these spills were not counted as pipeline spills. In any event, the spill

Table B-6. *Number of crude spills greater than or equal to specified spill threshold (1977-1999) by Operations segment and comparison with MMS estimates.*

	Assumed Threshold					
Segment	**250 bbl**	**500 bbl**	**750 bbl**	**1,000 bbl**	**10,000 bbl**	**100,000 bbl**
E&P	4	2	1	0	0	0
Pipeline	8	6	6	5	1	0
VMT	1	1	1	1	0	0
Marine Transportation	5	5	5	5	1	1
Total	18	14	13	11	2	1

Comparison with MMS Data for Spill Threshold >1,000 bbl
(TAPS throughput to date: 12.758 billion bbl)

Segment	**Empirical Spill >1,000 bbl (rate as number/billion bbl**	**MMS Rate (as number/billion bbl)**	**Remarks**
E&P	0.00	0.45	Figure at left for platforms
Pipeline	0.39	1.32	May include terminals
VMT	0.08		
Subtotal pipe and VMT	0.47		
Marine Transportation	0.39	1.1	Combination of 0.33 (in port) and 0.77 (at sea)

Source: MMS data from Beaufort Sea Planning Area Lease Sale 144 (1996)

rate for pipelines alone (1.32) is significantly greater than that for the Operations pipeline (0.39). Inspection of the spill events in the MMS database (Table 1 of Anderson and LaBelle, 1994) suggests that a greater spill rate for outer-continental-shelf pipelines compared to TAPS would be plausible. Although some accidents/failures leading to outer-continental-shelf spills are similar to those that might occur on TAPS (e.g., corrosion), most are quite different (illustrative causes of outer-continental-shelf spills are hurricane damage, anchor damage to pipeline, trawl damage to pipeline, etc.). Thus, there may be sound reasons why TAPS (an onshore pipeline throughout its length) has a lower spill rate than OCS pipelines.

Figure B-13 summarizes these comparisons. As noted above, there were no spills >1,000 bbl for E&P operations over the period from 1977 to 1999. The estimated large spill rate per billion bbl throughput is less than the MMS data would indicate.

Another benchmark that has been used for E&P activities is the number of blowouts per 1,000 wells drilled. Mallary (1998) analyzed ANS E&P activities over the period from 1974 to 1997. "Loss of secondary well control with a drilling rig on the well" (a blowout) can occur in one of two ways:

- A failure of a rig's blowout prevention equipment to contain a hydrocarbon influx in the well, which results in a surface blowout.
- A failure of the cemented casing in a well, which results in a subsurface blowout or annular migration of hydrocarbons to the surface.

From 1974 to 1997, there were six documented cases of loss of secondary well control, two surface blowouts and four subsurface blowouts. Over this same time period an estimated 3,336 wells were drilled by ARCO, BPXA, and other operators. Thus, the estimated blowout rate over this period was 1.8/1,000 wells drilled. This figure is slightly larger than, but comparable to, the reported rate (1.2/1,000 wells drilled) for Gulf Coast well drilling over the period 1960 to 1996 (Skalle and Podio, 1998).

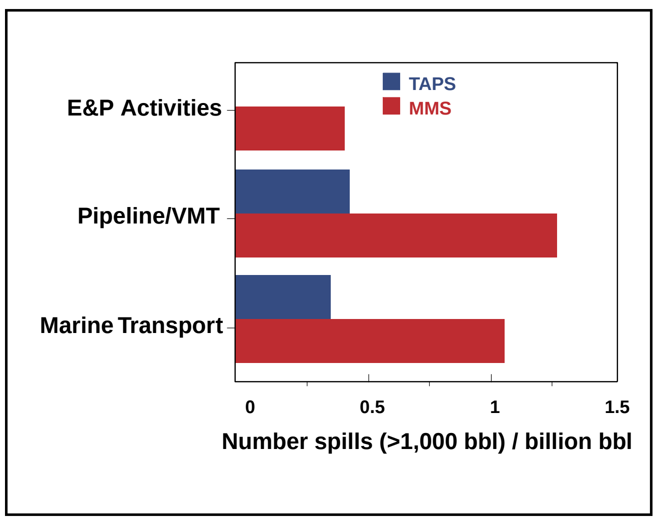


Figure B-13. *Number of large (>1,000 bbl) spills per billion bbl throughput for Operations compared to MMS data.*

Notwithstanding the EVOS, the observed rate of occurrence of large marine transportation spills (0.39/billion bbl throughput) is only 35 percent of that (1.1 large spills/billion bbl) expected on the basis of MMS data. The spill rate for marine transportation estimated by MMS is derived from data on ANS tankers over the period from 1977 to 1992 (Anderson and LaBelle, 1994). Part of the reason why the estimate presented here is lower is that few spills (and no spills >1,000 bbl) occurred in the marine transportation segment between 1992 and 1999.

Relative to a “zero defects” goal, any spill rate (however calculated) greater than zero is of concern. However, in terms of expectations based on actual data, Operations spill performance is better than reasonable benchmarks. Operations spills may be large in aggregate, but not relative to the quantity of oil handled.

B.4.6 Relevant Descriptive Statistics

Table B-7 provides relevant descriptive statistics for Operations spills by segment and material spilled. The number of spills, and minimum, maximum, median, and mean (arithmetic average) spill volumes are given in this table. Also presented are the Lorenz coefficients, standard deviations of spill size, the coefficients of variation (ratios of standard deviations to means), the skewness of the distribution (measured by the coefficient of skewness, G1, see, Kendall and Stuart, 1963), various percentiles of the CDF, and the 90 and 95 percent points of the Lorenz curves. As indicated by the facts that the median spill size is significantly less than the mean (arithmetic average) spill size, Lorenz coefficients are close to unity, and coefficients of variation and skewness are also large, these spill distribu-

Table B-7. *Characteristics of TAPS crude and product spills (1977-1999).*

		E&P Material Spilled		Pipeline Material Spilled		VMT Material Spilled		Marine Transportation Material Spilled	
Attribute/Item	Units	Crude	Product	Crude	Product	Crude	Product	Crude	Product
Number of spills 1977-1999		1,482	3,898	276	2,891	322	858	345	505
Average number of spills/year	spills/yr	67.36	177.18	12.55	131.41	14.64	39.00	15.68	22.95
Volume of spills 1977-1999	bbl	5,779	5,220	27,573	3,697	3,535	580	279,727	997
Average volume/year	bbl/yr	263	237	1,253	168	161	26	12,715	45
Spill size characteristics									
Lorenz coefficient, L	N/A	0.911	0.883	0.986	0.945	0.992	0.969	0.996	0.985
Minimum	bbl	0.001488	0.000628981	0.000007738	0.000030952	0.000007738	0.000000619	0.000061905	0.000000967
Maximum	bbl	925	450	16,000	238	3,200	298	257,143	681
Median	bbl	0.23800	0.11900	0.04760	0.07143	0.02380	0.00595	0.04762	0.00600
Mean	bbl	3.90	1.34	99.90	1.28	10.98	0.68	810.80	1.98
Standard deviation		33.88	10.02	1008.46	11.42	178.63	10.52	13856.07	30.82
Coefficient of variation		8.69	7.48	10.10	8.93	16.27	15.57	17.09	15.61
Skewness (G1)		20.08	28.53	14.62	14.24	17.84	26.64	18.51	21.45
Percentiles of spill volume CDF 0.05	bbl	0.0238000	0.0119000	0.0007420	0.0014857	0.0000310	0.0000310	0.0001000	0.0000310
0.10	bbl	0.023800	0.023800	0.001490	0.005950	0.000093	0.000062	0.000743	0.000100
0.20	bbl	0.04760	0.03570	0.00595	0.01190	0.00070	0.00037	0.00298	0.00074
0.50	bbl	0.23800	0.11900	0.04760	0.07143	0.02380	0.00595	0.04762	0.00600
0.80	bbl	1.6190	0.5952	0.7143	0.1905	0.2619	0.0952	0.7381	0.0476
0.90	bbl	4.000	1.429	4.000	0.476	0.774	0.357	3.000	0.236
0.95	bbl	7.55	4.00	25.00	1.19	2.00	1.00	11.90	1.19
x		y	y	y	y	y	y	y	y
Smallest x% of spills 90.00		12.98	15.75	0.25	6.20	0.81	4.15	0.03	0.87
account for y% of spill volume 95.00		19.76	24.66	0.80	9.28	1.38	8.17	0.07	2.17

tions are not symmetrical, but rather have long right tails (extreme values) for each of the Operations segments. Because of these characteristics, the familiar normal (bell shaped) distribution is not a suitable statistical model for description of spill volume data (more below).

B.4.7 The Distribution of Spill Volume

This section examines the statistical distribution of spill volumes. There are two reasons for this analysis:

- First, the distribution of spill volumes is of intellectual and practical interest. Knowledge of this distribution, among other things, enables selection of appropriate models for projection of the volume of future spills.
- Second, knowledge of the appropriate statistical distribution of spill volumes enables a more parsimonious representation of the data. Additionally, the statistical estimates may be more efficient than sample estimates.

This analysis concludes that the lognormal distribution provides an adequate (although not exact) representation of the spill volume data.

Several statistical models are appropriate candidates for describing the size distribution of spills. One obvious choice is the lognormal distribution (Rappaport, 1991, Maxim et al., 1994, 1997). As Table B-8 shows, the lognormal distribution has found wide applicability in a variety of fields. The lognormal distribution applies to variables constrained to take on only positive values and, depending upon its parameters, can assume a variety of shapes — including distributions with long right tails. It is defined mathematically as follows:

Let x be the random variable denoting the size of the spill. The distribution function for the lognormal variable x is given (Gilbert, 1987; Johnson and Kotz, 1970; Aitchison and Brown, 1969) by the equation:

(Eq. 1) $$f(x) = \frac{1}{x\sigma_y\sqrt{2\Pi}} \exp\left[-\frac{1}{2\sigma_y^2}\left(\ell n x - \mu_y\right)^2\right],$$

where x is the size of the spill, bbl, μ_y is the mean, and σ_y is the standard deviation of the *log-transformed* spill size y (i.e., y = lnx).

The density function of the random variable y is given by,

(Eq. 2) $$f(y) = \frac{1}{\sigma_y\sqrt{2\Pi}} \exp\left[-\frac{1}{2\sigma_y^2}\left(y - \mu_y\right)^2\right].$$

Table B-8. *Wide applicability of the lognormal distribution.*

Field	Examples	References
Physics	• Small particle statistics • Radionuclide data sets	Aitchison and Brown (1969) Gilbert (1987) Johnson and Kotz (1970)
Geology	• Gold and mineral assays	Aitchison and Brown (1969) Koch and Link (1971)
Economics	• Income or wealth distributions • Expenditures on particular commodities	Aitchison and Brown (1969)
Biology	• Size of organisms • Abundance of species	Aitchison and Brown (1969) Kendall and Stuart (1963)
Engineering	• Distribution of throughput before failure, time of failure • Flood flows	Aitchison and Brown (1969) Johnson and Kotz (1970)
Astronomy	• Distribution of stars	Aitchison and Brown (1969)
Industrial Hygiene	• Distribution of workplace toxic concentrations • Air quality data	Maxim et al. (1994, 1997) Rappaport (1991) Gilbert (1987)
Environmental Contaminant Data	• "Most commonly used probability density model for environmental contaminant data"	Gilbert (1987)
Geography	• City size distributions • Distances between towns and nearest neighbors	King (1969)

Thus, the random variable y = lnx follows a normal (bell-shaped) distribution.

Analysis of the distribution of spill volumes by segment indicates that the lognormal distribution provides an approximate fit. To illustrate, Figure B-14 (left) shows a histogram of observed crude spills from *E&P activities* over the period from 1977 to 1999. A logarithmic spill size axis is given. Superimposed on this histogram is the fitted lognormal distribution (which appears bell-shaped when plotted on a logarithmic axis) corresponding to these data (green curve). Although the match between the empirical frequencies and fitted frequencies is not exact, the lognormal distribution provides an approximate fit. Statisticians often use a "probability plot" to judge fit accuracy. The axes of this plot are designed so that, if the assumed distribution is correct, the points will plot as a straight line. Figure B-14 (right) shows the lognormal probability plot for these data *(Systat*, 1997). There is some slight curvature evident in the plot, but it suggests that the lognormal distribution provides an adequate fit to the E&P spill data.

Figure B-15 provides similar plots (to those shown in Figure B-14) but for the *pipeline* segment. As is the case with E&P spills, the lognormal distribution provides an approximate fit to the observed spill data.

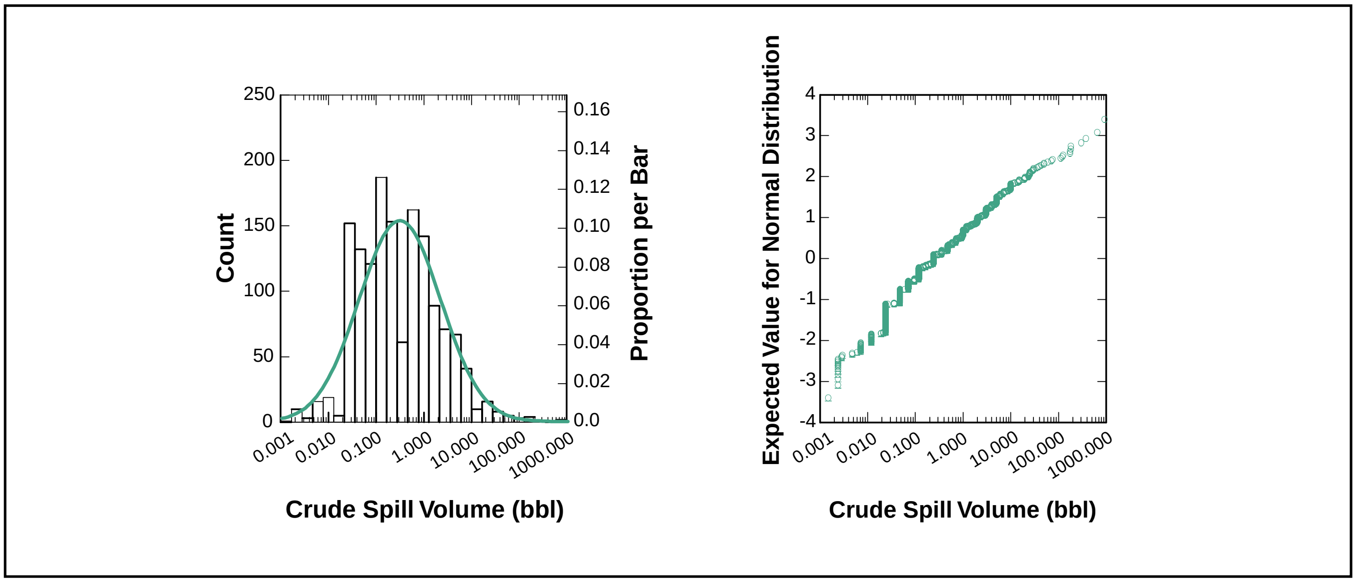


Figure B-14. *Observed histogram of E&P crude spills (log scale) and fitted normal distribution (left-hand side) and normal probability plot of same data (right-hand side) confirm approximate lognormality of spill volume distribution.*

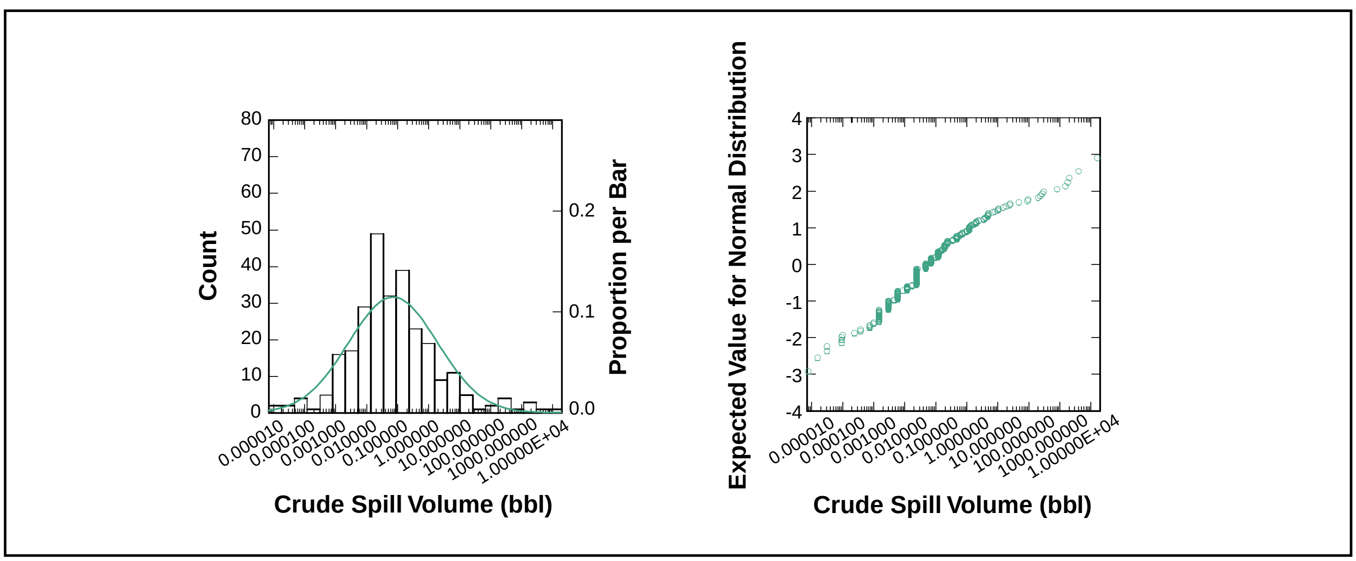


Figure B-15. *Observed histogram of pipeline crude spills (log scale) and fitted normal distribution (left-hand side) and normal probability plot of same data (right-hand side) confirm approximate lognormality of spill volume distribution.*

"Bumps" in the probability plots (right-hand sides of Figures B-14 and B-15) could arise as a result of rounding estimates of spill volumes (see e.g., Anderson and LaBelle, 1990). The slight curvature evident in the probability plots could indicate that the statistical characteristics of small and large spills differ and, therefore, that the observed distribution of spill volumes are a mixture of two separate distributions. Some analysts (see e.g., Smith et al., 1982) have suggested that oil spills of different magnitudes ". . . may be expected to exhibit different statistical properties in their occurrence." "Bowed" probability plots can result from mixtures of distributions (Koch and Link, 1971, see especially p. 247).

Analysis of VMT and marine transportation spills support the above findings for E&P and pipeline spills. All probability plots confirm that the lognormal distribution provides an approximate description of the distribution of spill volumes.

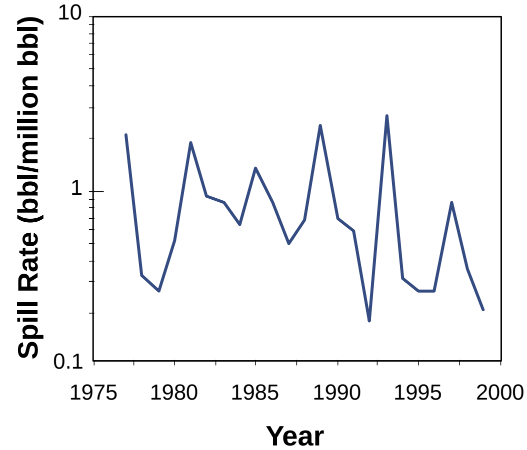


Figure B-16. *Volumetric spill rate for E&P activities (1977-1999).*

B.5 Time Trends

This section examines time trends of crude and product spills from various Operations segments. It is necessary to consider time trends to develop informed projections of possible future spills associated with continuing Operations if the ROW is renewed.

In accord with modern spill analysis methodology (see Table B-2) it is reasonable to normalize spill volumes in relation to an *exposure variable.* Several bases for normalization have been suggested in the literature. The exposure variable typically used in MMS studies is the volume of material produced or handled. Therefore, an appropriate statistic is the *volumetric spill rate* expressed as the volume of crude and product spilled divided by the volume of material produced or transported.

The following sections provide what are believed to be conservative projections of spill volumes over the period (2004-2034) of the ROW renewal. Alyeska management and those of ANS E&P operators and shippers are committed to reducing spill volumes (indeed, spill volumes are elements of various performance contracts). To the extent that these efforts are successful, future spill volumes will be less than those estimated here. Possible progress in reducing the frequency of large marine spills is presented below.

B.5.1 E&P Activities

Figure B-16 presents volumetric spill rates by year for the E&P segment of Operations from 1977 to 1999. The y-axis is the volumetric spill rate defined as the total annual volume of crude and product spilled divided by the total annual crude throughput. Convenient units are bbl spilled per million bbl throughput. The x-axis is time in years.

There is a substantial variability of approximately one order of magnitude in year-to-year volumetric spill rates over this period and little apparent time trend. A linear regression (fitted by ordinary least squares) has a negative slope, suggesting that volumetric spill rates have declined slightly on average, but the percentage variation explained by this regression is small ($R^2 = 0.114$) and the 95 percent confidence limits on the slope (change in rate over time) include zero, indicating that there is no statistically significant time trend.

Since there is no persuasive evidence of a time trend based on actual data, the historical average volumetric spill rate provides the best estimate of future spills for this segment. Dividing the total amount spilled in E&P activities by the total TAPS throughput from 1977 to 1999 yields an average annual spill rate of 0.86 bbl/million bbl throughput. Because TAPS throughput volumes are projected to decrease in the future (see Appendix A), the assumption of a constant average spill rate (per million bbl throughput) means that future E&P spills will decrease in proportion to throughput. The baseline future TAPS throughput assumption over the period from the year 2004 to 2034 totals approximately 7.02 billion bbl (Appendix A). Therefore, the projected average volume of ANS crude and product spills is approximately 6,050 bbl over the period from 2004 to 2034, an average of 202 bbl/year.

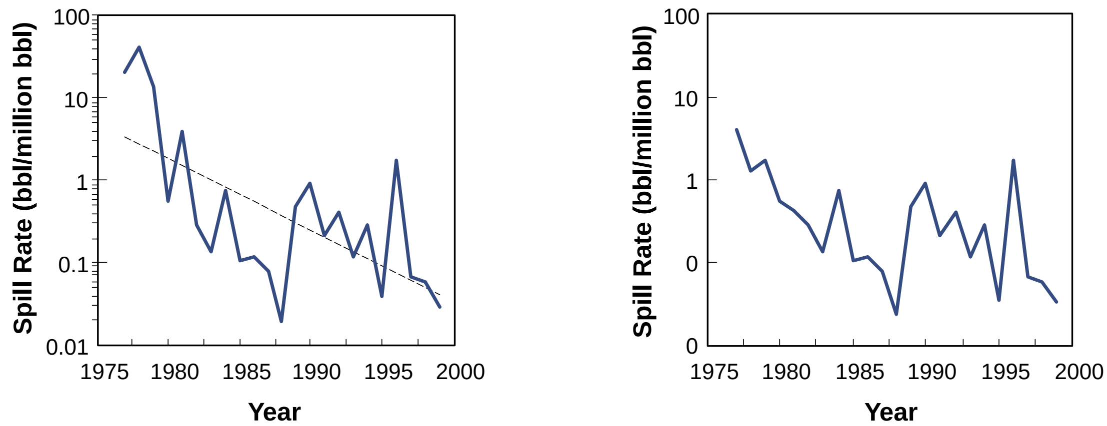


Figure B-17. *Left-hand side: Volumetric spill rate for pipeline (solid line) and ordinary-least-squares trend (dashed line) (1977-1999). Right-hand side: Same data with five largest pipeline spills removed.*

B.5.2 Pipeline

There is some debate about the magnitude of future pipeline spills as TAPS ages. Available evidence from European pipelines (CONCAWE, 1998) suggests that older pipelines have the same spill rates as newer pipelines. However, some TAPS critics have expressed the concern that pipeline spills may be more likely in the future (Fineberg, 1997) as the system ages.

Figure B-17 (left) presents volumetric spill rates by year for the pipeline. As with the E&P data (and data from all segments), there is substantial variability (approximately three orders of magnitude for this segment), but evidence of a trend toward decreasing volumetric spill rates in later years. (This conclusion is strengthened if it is believed (see Table B-2) that pre-1989 data may have been understated.) An ordinary-least-squares linear regression line [the dashed line in Figure B-17 (left)] has a negative slope, which is significantly different from zero ($p = 0.001$), confirming the visual impression offered by Figure B-17 (left). Nonetheless, the predictive power of the linear trend model ($R^2 = 0.431$) is not high, indicating that year-to-year variability is large relative to any time trend. For this reason, it is conservatively assumed that the volumetric spill rate is constant over time. Figure B-17 (right) plots pipeline spill rate through time but excludes the effects of the five largest pipeline spills. These larger spills occurred in the earliest years of TAPS (1977 to 1981) and represent 19 percent of the total volume spilled from the pipeline segment. Even with these points deleted, there is visual evidence of a trend, particularly in the early years.

The average volumetric spill rate (crude and product) is 2.45 bbl spilled/million bbl throughput. From the baseline throughput assumption (see above), the estimated average future pipeline spill volume is 17,200 bbl over the ROW renewal period, an average annual spill volume of 573 bbl. If the observed time trend persists, the actual volume spilled would be substantially lower.

B.5.3 VMT

Figure B-18 presents calculated volumetric spill rates for the VMT segment. Spill rates are highly variable (about four orders of magnitude) and there is no evident time

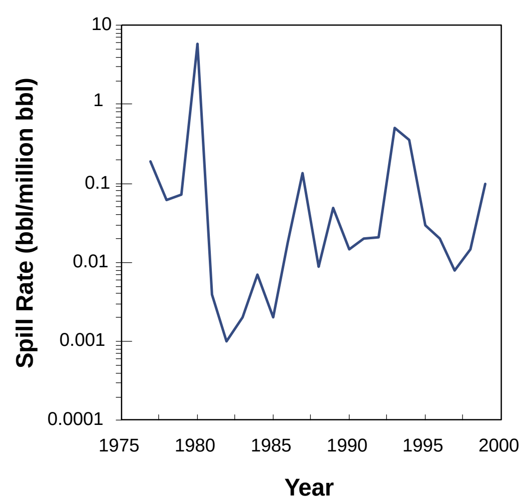


Figure B-18. *Volumetric spill rate for VMT (1977-1999).*

trend. The annual average spill rate is 0.32 bbl crude and product spilled/million bbl throughput, which translates to a total spill volume of 2,270 bbl (average 76 bbl/year) over the ROW renewal period.

B.5.4 Marine Transportation

Figure B-19 presents comparable rates for the marine transportation segment. Variability is nearly six orders of magnitude and there is no statistically significant time trend. The annual average volumetric spill rate for this segment is 22 bbl crude and product spilled/million bbl crude throughput, which translates to an expected spill volume of approximately 154,400 bbl (average 5,147 bbl/year) over the ROW renewal period. Because marine transportation spills are potentially so important, this projection is examined in more detail in following sections.

B.6 Choice of Data Set

The above estimates of future spill volumes over the ROW extension period 2004 to 2034 are based on the entire data set of spills occurring on all TAPS segments for the period from 1977 to 1999. As noted, there are clear time trends in volumetric spill rates for the pipeline segment and, because of the contributions of the EVOS volume to the total, an evident step-change in spill volumes for the marine transportation segment for the post-1990 period. If there are real trends in volumetric spill rates, then it is appropriate to base spill volume estimates upon more recent data. The year 1990 serves as a useful point to partition the data. Following the EVOS in 1989, numerous enhancements were made to spill response capabilities and other measures were implemented (see below) to reduce the likelihood and/or consequences of a marine transportation accident. Table B-9 shows the projected total and annual spill volumes (by segment and in aggregate) calculated using volumetric spill rates (as illustrated above) based on all (1977 to 1999) data and upon the subset of most recent data for the period from 1990 to 1999. Figure B-20 shows these same results graphically.

As can be seen, projections of future spill volumes are quite sensitive to the historical period used to estimate volumetric spill rates. If the 1990 to 1999 period were chosen, projected spill volumes are approximately 88 percent lower than if the entire operating period were chosen — largely because of very substantial drops in projected pipeline and marine transportation spills. Data used for spill volume projection cannot be chosen arbitrarily or merely because the results provide greater comfort to the stakeholders. There must be some objective reason(s) to justify the deletion of any potentially relevant data. With regard to the TAPS system, such reasons include:

- The 1990 to 1999 period is more recent. In the presence of time trends, the choice of more recent baseline is preferable. Of course, selecting the more recent data set also reduces the number of years of data, which reduces the possible precision of the projections.

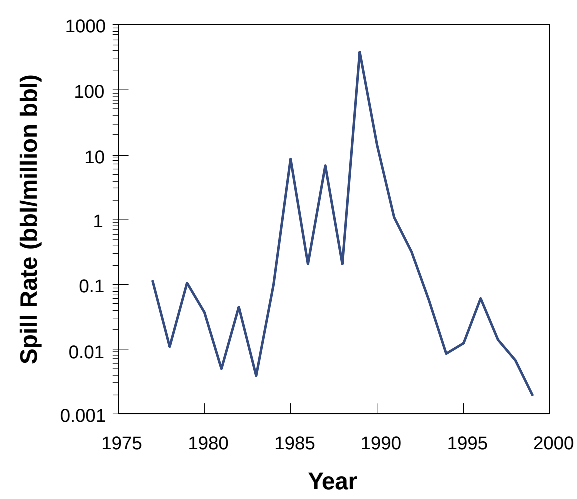


Figure B-19. *Volumetric spill rate for marine transportation (1977-1999).*

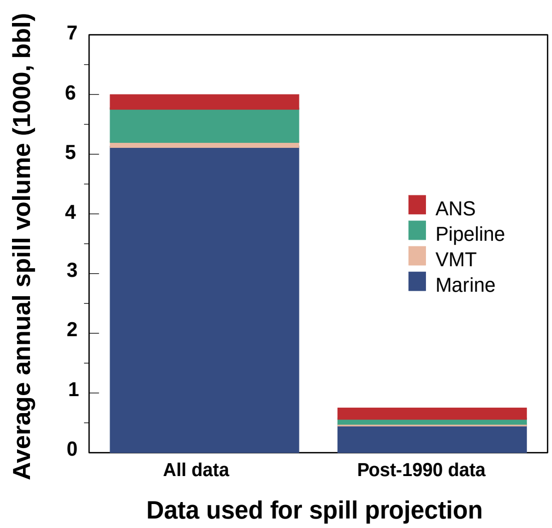


Figure B-20. *Projected total and annual spill volumes (by segment and in aggregate) calculated using volumetric spill rates (as illustrated above) based on all (1977-1999) data and upon the subset of most recent data for the period from 1990 to 1999.*

Table B-9. *Spill projections based on different data sets.*

Operations Segment	1977-1999 Data Set Total Volume 2004-2034 (bbl)	1977-1999 Data Set Average/Year 2004-2034 (bbl)	1990-1999 Data Set Total Volume 2004-2034 (bbl)	1990-1999 Data Set Average/Year 2004-2034 (bbl)	Percent Change
E&P (ANS)	6,050	202	4,806	160	–20.8
Pipeline	17,200	573	3,045	102	–82.2
VMT	2,270	76	801	27	–64.4
Marine Transportation	154,400	5,147	13,658	455	–91.2
Total	179,920	5,998	22,310	744	–87.6

Note: Estimated spill volumes based on average volumetric spill rates

- There have been many enhancements made (see below) to the marine transportation system following the EVOS and other marine spills in order to reduce the likelihood of future accidents and expected volume of oil spilled given an accident.

B.7 Future Marine Transportation Spills

The historical importance of marine transportation spills justifies a more careful examination of the prospects of future spills than merely concluding (based solely on the lack of an obvious time trend in spill data) that "the future will be like the past."

It is not impossible for a very large tanker spill to occur during the period covered by the ROW extension. However, based on lessons learned as a result of the EVOS, new legislation (e.g., OPA 90), and new regulations, numerous improvements have been made that will reduce the likelihood of a major marine transportation accident and/or the expected outflow given such an accident. These measures fall into two main classes:

- Improvements in spill prevention and response capability for Prince William Sound (PWS) made by Alyeska, including the creation of the Ship Escort Response Vessel System (SERVS).
- Phase-in of double-hull tankers under OPA 90.

Table B-10 provides a summary of the major changes made by Alyeska between 1989 (pre-EVOS) and the present relevant to PWS. Key spill prevention measures include provision of tanker escorts, and enhanced USCG-staffed Vessel Traffic Service (VTS), more stringent weather constraints on tanker operation, use of ice routing measures, and mandatory alcohol testing of tanker officers. Collectively, these measures (costing approximately $60 million annually) are designed to reduce the likelihood of a tanker accident and the size of any subsequent spill substantially. Shown also in Table B-10 are a series of measures that are designed to improve response capability. [Many of these were developed from a Coast Guard study of "lessons learned" during the EVOS cleanup (USCG and DOT, 1993)]. These measures should reduce the environmental impacts of a spill.

Among other things, OPA 90 established a schedule for closing U.S. ports to single-hull tankers. By 2015 at the latest, all tankers calling at VMT will have double-hulls. In fact, according to projections made by the U.S. General Accounting Office (GAO, 1990, 1999) the last of the present tanker fleet will be phased out in 2013. Thus, for at least 20 years of the 30-year ROW renewal period (2014 to 2034), the ANS tanker fleet will consist exclusively of double-hull tankers. (Of 26 tankers now serving VMT, 3 are double-hull, 13 have double sides, and an additional 3 double-hull tankers are on order, scheduled to enter service before the existing TAPS ROW expires.)

Shortly after the EVOS, a National Transportation Safety Board report (NTSB, 1990) stated that had the *Exxon Valdez* been fitted with a double hull, "the risks of oil spills owing to collision or grounding would have been significantly reduced."

Table B-11 provides several estimates of the benefits of double-hull tankers in terms of a reduced probability of an oil spill and/or reduced outflow in the event of a spill. Of these, the recent National Research Council study (NRC, 1998) offers the most authoritative estimates of measures of effectiveness of double-hull tankers compared to existing single-hull tankers. As can be seen, this study estimates that the probability of a spill would be reduced by an "improvement factor" ranging from 4 to 6, and the expected spill outflow reduced by an improvement factor of between 3 and 4. Together, improvements in prevention and phase-in of double-hull tankers should reduce spill probabilities and spill outflows at PWS appreciably.

There have been (and will be) many additional improve-

Table B-10. *Prince William Sound spill prevention and response.*

Category	Before March 1989*	Fall 2000*
Tanker, Escort, Tracking, and Operations	• Vessel escort only through Valdez Narrows • USCG radar tracking to pilot station (past Valdez Narrows) • No drug and alcohol testing for tanker crews	• 3 prevention and response tugs (PRTs), 2 enhanced tractor tugs (ETTs), and 4 conventional tugs • USCG Vessel Traffic Service; enhanced radar coverage; automated vessel tracking in Prince William Sound (PWS) • Tanker officer alcohol testing prior to sailing; weather restrictions on tanker operations; ice routing measures; tankers boomed during loading at Valdez Marine Terminal (VMT)
Oil Spill Recovery and Nonmechanical Response Systems	• 13 oil-skimming systems with recovery capability of 27,000 bbl of oil in 72 hours • 1 barge with 12,000 bbl storage for recovered oil • Approximately 5 miles of containment boom; no fire boom/igniter systems • Limited dispersant and application systems in place	• Major SERVS response equipment on 24-hour standby. • Over 70 skimming systems with recovery capability of 300,000 bbl of oil in 72 hours • 7 barges with 818,000 bbl storage for recovered oil • At least 35 miles of containment boom plus over 3,000 ft of fire-resistant boom with 2 helicopter igniter systems • Dispersant stockpile of over 60,000 gallons with fixed-wing, helicopter, and vessel-based application systems
Spill Planning, Management, and Training	• Contingency plan developed for "most likely" spill scenario of 4,000 bbl • Drills conducted every few years outside Port Valdez • Response team in place resembled a command system • Valdez Terminal employees provided response personnel; no SERVS organization	• State-approved comprehensive Oil Discharge Prevention and Contingency Plan developed by shippers and Alyeska for response planning standard of 300,000 bbl • Major tanker drill conducted annually with frequent smaller drills • Weekly drills and training exercises • Unified Incident Command System structure with USCG, Alyeska, shippers, and state for incident response • Alyeska SERVS is the dedicated, trained spill response organization with over 200 personnel and contractors
Community Involvement, Response, and Training	• No organized citizen involvement in plan development and oversight • No community response centers • No community training programs • Approximately 10 fishing vessels at Port Valdez under contract for spill response	• PWS Regional Citizens' Advisory Council budget for 2000 is $2.5 million • 5 Community Response Centers in PWS • Community training programs in PWS and Kodiak • Program trains and integrates fishing vessels in oil spill response plans; over 300 fishing vessels under contract
Wildlife and Resource Protection	• No specific fish hatchery protection plans • No specific wildlife rescue programs	• Hatchery protection plans with pre-staged equipment for all hatcheries in PWS • Wildlife response plan with hazing, capture, and rehabilitation equipment on site and ready for rapid deployment
Communications	• Radio communications for spill response from scene to command center only	• Fixed radio repeater system with communications capability to cover PWS
Government Oversight	• State oversight at Valdez Terminal and tanker operations by 3 on-site state employees	• Comprehensive oversight of VMT and tanker operations by federal and state agencies, including the Joint Pipeline Office; 7 specially trained on-site state personnel
Spill Prevention and Response Budget	• Approximately $1 million annual for VMT and PWS	• Approximately $60 million annually

*Based on oil spill contingency plans reviewed and approved by ADEC and by the USCG for 1999.
Note: ADEC (www.state.ak.us/dec/) offers a similar list (Feb. 1999) titled "Then and Now."

Source: APSC (1999c) with slight modification.

Table B-11. *Potential benefits of double-hull tankers.*

Statement	Summary	Source
"If a vessel experiences a collision or grounding that penetrates the outer hull, double-hull tankers are four to six times less likely than single-hull tankers to spill oil. Expected or average outflow is three to four times less with a double-hull compared to a single-hull tank vessel."	Probability of spill reduced by factor of 4 to 6. Expected spill volume reduced by factor of 3 to 4.	NRC (1998)
"After the *Exxon Valdez* grounded on Bligh Reef, the Coast Guard estimated that 25 to 60 percent of the spilled oil . . . could have been contained if vessel had a double hull."	Expected spill volume reduced by factor of 1.33 to 2.5.	Davidson (1990)
"It is estimated that if the *Exxon Valdez* had had a double-hull structure, the amount of the spill would have been reduced by more than half."	Expected spill volume reduced by factor >2.	*Exxon Valdez* Oil Spill Trustee Council (www.oilspill.state.ak.us)
"If the *Exxon Valdez* tanker had been protected by a double hull, 80% less oil would have spilled . . . a marine architect told a house panel . . . "	Expected spill volume reduced by factor of 5.	Whitney (1990)
"A risk assessment study done in 1995 found the risks of another spill have been reduced by 75%, according to Michelle Brown, Commission of the State Department of Environmental Conservation."	Probability of spill reduced by factor of 3.	Clark (1999) Det Norske Veritas et al. (1996)
"Oil outflow for a double-hull tanker for composite accident reduced to 29% for large tankers."	Expected spill volume reduced by factor of >3.	NRC (1991)

ments beyond those summarized in Table B-10 that should reduce the probability of an accident and/or the expected volume of crude spilled in the event of an accident. As noted above, double-hull tankers will replace single-hull tankers. However, the new tankers will be different in other respects as well. For example,

- New tankers should have a reduced probability of developing hull cracks compared to the older tankers presently in service. In addition, the USCG has instituted a Critical Area Inspection Program for all tankers in the TAPS trade (APSC, 1999b). This program is intended to reduce the likelihood of undetected hull fractures, which could result in crude oil discharges.
- Present tankers have been retrofitted with and new tankers will be equipped with more modern navigation receivers. Since the EVOS, both the satellite-based Global Positioning System (GPS) and Differential Global Positioning System (DGPS) systems have been placed into service (NRC, 1994). GPS offers a significant improvement in absolute accuracy compared to Loran-C (the system in use during the 1980s) and DGPS (a system operated by the Coast Guard that operates by broadcasting correction signals to be applied to the GPS position) offers yet greater improvement (10 meters absolute accuracy). There are three DGPS sites that provide coverage of the Valdez-Cape Hinchinbrook area, located at Cape Hinchinbrook, Kenai, and Potato Point (USCG, 2000a). With the recent decision (implemented May 1, 2000) to eliminate selective availability (SA, an intentional degradation of the GPS signal implemented originally out of national security concerns), DGPS accuracy will be significantly greater — perhaps 3 to 5 meters according to some sources (Queeney, 2000).
- New tankers will be able to maintain "position awareness" to a significantly greater degree. These will use Electronic Chart Display and Information Systems (ECDIS), a navigation system that displays real-time position information (from DGPS) on an electronic chart, replacing time-consuming position plotting on paper charts (NRC, 1994) and facilitating navigation and avoidance of charted hazards to navigation.
- New tankers will be equipped with Automatic Identification Systems (AIS), transponder-based systems that will transmit such ship information as identification, position, heading, ship length, beam, type, draught, and hazardous cargo information, to ships and shore (USCG, 1997b; Petterson, 2000; USCG, 2000b; Elfring, 2000). GPS/DGPS and radar are used to answer the question, "Where am I?" ECDIS is used to answer the question, "Where am I in relation to charted objects (e.g., reefs, aids to navigation, landmarks, etc.)?" Radar and Automatic Radar Plotting

Aids are used to answer the question, “Where are other vessels?” AIS is/will be used to answer a much more complete set of questions, including, “Where am I?” “Where are they?” “Who are they?” “Which way are they headed?” What is their course and speed?” “What is the closest point of approach and time to the closest point of approach?” AIS information can be presented as an ECDIS overlay, radar overlay, or on a personal computer (PC). Portable AIS systems, small enough to be carried by pilots, have been produced. Enhanced AIS (EAIS, see Elfring, 2000) will integrate this information with services available from VTS and non-USCG sources to provide waterway information (e.g., weather, currents, depth, ports, etc.). Once consigned to the realm of science fiction, the technology is now available. The 72nd Session of the International Maritime Organization Maritime Safety Committee has established a timetable for carriage requirements (USCG, 2000b) and prototype systems have been implemented (USCG, 1997b) in some areas to solve specific local problems (e.g., VTS Prince William Sound incorporates a ship-to-shore AIS for tank ships only).

Other mitigating actions (APSC, 1999b) include the implementation of new training and improved loading procedures to minimize tank overflow problems. Tankers are fitted with automatic or remote gauging systems and high-level alarms to minimize the possibility of tank overflow. Ship auditing practices, preventive maintenance, and inspections are designed to identify defects that could result in a spill.

Table B-12 provides a discharge history of all spills greater than 55 gallons from either VMT or the marine transportation link (APSC, 1999b, augmented with marine spills outside of the Valdez area). Hull cracks/corrosion leaks and overflowing tanks, for example, account for several of these spills. The likelihood of these failures should be reduced by the Critical Area Inspection Program, use of automatic/remote gauging systems, and high-level alarms. Improved training and preventive maintenance should also reduce the probability of these accidents.

Collectively, there have been numerous major and minor changes made to the marine transportation system since the EVOS. Many occurred almost immediately as “lessons learned” were assimilated, some have arisen out of a process of continuous improvement during the 1990s, and some (e.g., switch to double-hull tankers) will occur during the renewal period.

There is already statistical evidence (from other parts of the world) to support the fact that tanker spills are becoming less likely. Coast Guard Commandant Admiral James Loy recently reported to Congress that the number of major tanker spills has dropped by two-thirds since passage of OPA 90 (Whitney, 1999).

For these and other reasons, future marine transportation spills are expected to be less likely — perhaps much less likely — than past experience would indicate. For illustrative purposes, we have assumed a range of possible spill reduction factors in this analysis. Double-hulls alone should reduce spills by more than 80 percent (NRC, 1998). To be conservative and reflect the fact that single-hull tankers will be used for a portion of the ROW renewal period, *it is assumed that the future spill rate* (expressed as the number of spills of volume >1,000 bbl/billion bbl throughput) *will be less than that observed by an improvement factor ranging between 1 and 4.* The lower end of the range (improvement factor = 1) represents the status quo, the upper-end (improvement factor = 4) a conservative estimate of the benefits of double-hulls and other measures.

B.8 Spill Projections

This section develops projections of the likelihood and volume associated with both small and large spills over the period of the ROW extension based on the spill projection methodology employed by MMS, Operations experience, and estimates of the possible reduction of spill rates brought about by Alyeska measures taken at PWS and benefits of replacing the existing fleet of single-hull tankers with modern double-hulled equivalents.

B.8.1 Future Large Spills

In brief, the methodology for large (>1,000 bbl) spills is as follows:

- Marine transportation data for Operations are analyzed to estimate the base case spill rate (number of spills >1,000 bbl/billion bbl throughput).
- The base-case assumption of future throughput over the ROW renewal period is multiplied by the base case spill rate to determine the expected number of large spills in this period.
- This estimate is multiplied by several possible improvement factors to reflect the changes made to the spill prevention and response system to calculate a revised estimate of the expected number of future spills over the ROW renewal period.
- The Poisson model is employed to calculate the probability of any number of spills over the ROW renewal

Table B-12. *Discharge history of all spills greater than 55 gallons from either VMT or the marine transportation link.*

Date	Tanker	Cause/ Description	Spill Volume (bbl)
11/28/77	*Glacier Bay*	Crack in port side of tanker	12
07/29/78	*American Independence*	Ballast water discharge	3
09/05/78	*Tonsina*	Tanker overflow	5
10/17/78	*Aquila*	Unknown	10
11/09/78	*Manhattan*	Tank overflow	2
01/03/79	*Mobil Arctic*	Crack between ballast tank and crude tank	50
02/08/79	*Exxon San Francisco*	Tank overflow	5
02/03/80	*Mobil Oil*	Tank overflow	5
04/14/80	*Bay Ridge*	Ballast valve left open while pumping crude	29
07/08/80	*BT San Diego*	Connection flange on loading arm	4
09/11/80	*Exxon San Francisco*	Contaminated ballast water	10
08/16/82	*Bay Ridge*	Fault in line to ballast tank	2
10/01/82	*Brooklyn*	Leak in segregated ballast line	25
12/30/83	*ARCO Alaska*	Manifold overflow	1
08/26/84	*ARCO Alaska*	Corroded inert gas deck seal drain	60
12/21/85	*ARCO Anchorage*	Tanker ran aground in Port Angeles, WA	5,690
04/13/86	*BT San Diego*	Failure of slop tank valves	24
05/18/86	*Thompson Pass or ARCO Fairbanks*	Unknown origin (insufficient information to attribute to either tanker)	2
06/20/86	*Thompson Pass*	Hull crack	2
02/03/87	*Mobil Meridian*	Leak in upper rudder bearing	5
07/02/87	*Glacier Bay*	Tanker struck uncharted rock and went aground in Cook Inlet	4,942
01/11/88	*Exxon Benicia*	Unknown	3
02/12/88	*Exxon Benicia*	Hull corrosion leak	7
01/03/89	*Thompson Pass*	Hull crack	1,700
01/16/89	*Cove Leader*	Hull fracture-mechanical	60
03/11/89	*St. Lucia*	Overflow of tank compartment	3
03/24/89	*Exxon Valdez*	Ran aground on Bligh Reef	257,143
04/10/89	*Keystone Canyon*	Cracked overboard discharge line	2
02/07/90	*American Trader*	Vessel grounded on own anchor during mooring at Gold West Marine Terminal off Hunting Beach, CA	9,458
05/21/94	*Eastern Lion*	Corrosion hole in #1 port cargo tank	200

Source: APSC (1999b) as augmented with data for marine transportation spills outside of PWS.

period based on the revised estimates of the mean number of spills.

- Estimates of the average size of the large spills are presented.

Several investigators have found the Poisson model suitable for oil spill calculations (see e.g., Smith et al., 1982; Anderson and LaBelle, 1990, 1994). The Poisson model is used in the MMS oil spill models in several EISs. More generally, the Poisson model has been shown to be applicable to the areal distribution of objects (Clarke, 1946; Clark and Evans, 1954), queuing theory (Fry, 1965), reliability theory (Shooman, 1968), accidents (Wadsworth and Bryan, 1960; Parzen, 1960), acceptance sampling (Duncan, 1965), and other miscellaneous applications (e.g., Wallis, 1936).

The Poisson model is used as follows: denoting the spill rate (spills >1,000 bbl/billion bbl throughput) by λ and the estimated future throughput over the ROW renewal period by T (billion bbl), the expected number of large spills, μ, is equal to λT. Given μ, the probability of exactly k large spills (k = 0, 1, 2, etc.) over the future production period is,

(Eq. 3) $$p[k,\mu] = e^{-\mu}\frac{\mu^k}{k!}$$

The probability of at least one large spill is, therefore,

(Eq. 4) $$p[k \geq 1,\mu] = 1 - p[k=0,\mu] = 1 - e^{-\mu}$$

Table B-13 shows the calculated probability of any number of large spills over the ROW renewal period for various possible values of μ. Possible reductions in the historical large spill rate are quantified by an assumed improvement factor ranging from 1 (no improvement) to 6 (the upper end of the National Response Center estimate). Figure B-21 shows these probabilities graphically for improvement factors of 1 (base case — no improvement), 3 (67 percent reduction in spill rate), and 4 (75 percent reduction in spill rate).

For the base case, the probability of one or more spills >1,000 bbl (see Table B-13) is nearly 94 percent over the ROW renewal period. The corresponding probabilities for improvement factors of 3 and 4 are 60 and 50 percent, respectively

What is the expected size of a large spill? Although a large spill is defined as one >1,000 bbl, the average volume of such spills is greater than the threshold value. Based on

Table B-13. *Probability calculations for future marine spills over ROW renewal period.*

Quantity	Units	Value	Source/remarks
Observed number of spills >1,000 bbl	NA	5	see Table B-4
Total TAPS throughput (1977-1999)	billion bbl	12.758	ASPC (1999a) updated
Spill rate for these data	spills/billion bbl	0.391911	Ratio spills/throughput
Baseline TAPS throughput in ROW period	billion bbl	7.02	Appendix B
Expected # spills in ROW period	# spills	2.751	Calculation

Probability of indicated number of spills >1,000 bbl over renewal period
If actual spill rate is this fraction of observed TAPS marine transportation spill rate

	Assumed improvement factor relative to historical rate							
	1	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**6**
	Resulting mean number of spills (2004-2034)							
	2.751	**1.834**	**1.376**	**1.100**	**0.917**	**0.786**	**0.688**	**0.459**
Number of Spills	**Probability**	**Probability**	**Probability**	**Probability**	**Probability**	**Probability**	**Probability**	**Probability**
0	0.0639	0.1598	0.2527	0.3327	0.3997	0.4556	0.5027	0.6322
1	0.1757	0.2930	0.3476	0.3661	0.3665	0.3582	0.3457	0.2899
2	0.2416	0.2687	0.2391	0.2015	0.1681	0.1408	0.1189	0.0665
3	0.2216	0.1643	0.1096	0.0739	0.0514	0.0369	0.0273	0.0102
4	0.1524	0.0753	0.0377	0.0203	0.0118	0.0072	0.0047	0.0012
5	0.0839	0.0276	0.0104	0.0045	0.0022	0.0011	0.0006	0.0001
6	0.0385	0.0084	0.0024	0.0008	0.0003	0.0001	0.0001	0.0000
7	0.0151	0.0022	0.0005	0.0001	0.0000	0.0000	0.0000	0.0000
8	0.0052	0.0005	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0016	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14 or more	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1 or more	0.9361	0.8402	0.7473	0.6673	0.6003	0.5444	0.4973	0.3678

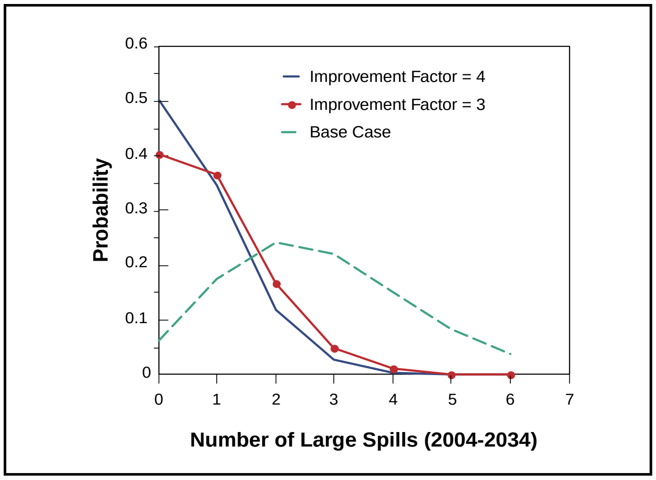


Figure B-21. *Probability distribution of number of large spills in ROW renewal period (2004-2034) for various improvement factors.*

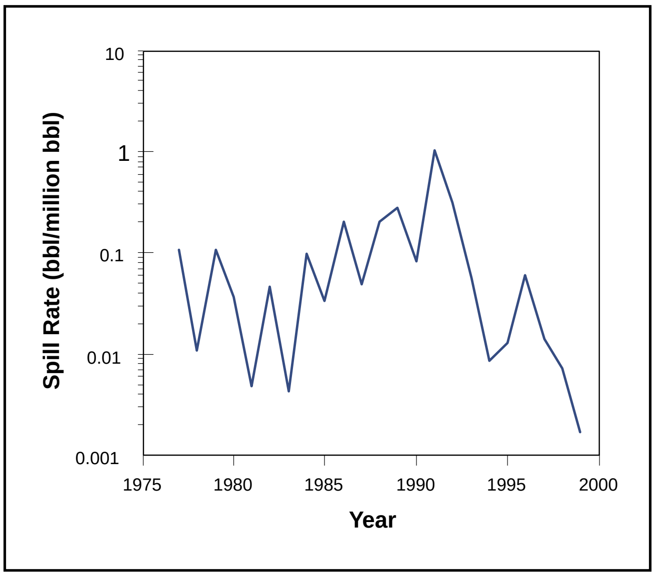


Figure B-22. *Volumetric spill rate (crude and product) for marine transportation spills <1,000 bbl.*

observed marine transportation spills for Operations over the period from 1977 to 1999 (including EVOS) the average size of all spills greater than 1,000 bbl (the conditional mean) was approximately 55,800 bbl. However, as noted above, it is likely that the size of any large spill would also be reduced by the same measures that reduce the spill probability. A recent (MMS, 1996) EIS, for example, posits an average large spill volume of 30,000 bbl for ANS tankers.

Based on the MMS oil spill methodology and conservative estimates of possible improvement, this analysis concludes that:

- The likelihood of one or more large (>1,000 bbl) crude spills for the marine transportation link ranges from 50 percent (improvement factor 4) to 94 percent (no improvement).
- The expected number of large spills ranges from 0.69 (improvement factor 4) to 2.75 (no improvement).
- The estimated volume of a large tanker spill is 30,000 bbl.
- The estimated total volume of oil spilled as a result of large spills over the ROW renewal period ranges from 0.69 (30,000) = 20,700 bbl to 2.75 (30,000) = 82,500 bbl. Spread over 30 operating years the average volume spilled over the marine transportation segment ranges from 690 bbl/yr to 2,750 bbl/yr.

These projections present a more optimistic picture of future marine transportation spills than that determined solely from historical data. The specific improvement factors assumed here are arbitrary, but conservative relative to the range of improvement factors reported in the literature.

B.8.2 Future Small Spills

Because large spills account for the vast majority of the oil spilled in the marine transport segment of Operations, the consequences of omitting small spills from the analysis are likely to be negligible in terms of projections of the volume of future oil spills from Operations. Nonetheless, for the sake of completeness, these are included. To begin, Table B-14 shows the spill volumes (crude, product, and total) associated with spills less than or equal to 1,000 bbl for the marine transportation link over the period from 1977 to 1999. This table was prepared by deleting all marine transportation crude or product spills >1,000 bbl from the database and recalculating yearly totals for crude, product, and total spills. The combined volumetric spill rate (bbl crude and product spilled/million bbl throughput) for these small spills is calculated from the yearly totals and TAPS throughput.

Figure B-22 shows a time series of the annual volumetric spill rate (crude and product total) from 1977 to 1999 for these small spills. Over this entire time period there is no statistically significant time trend, although it is possible that these have decreased since 1991. Though targeted at large spills, some of the post-1990 measures discussed above may also reduce the frequency and/or volume of small spills. These potential benefits are disregarded in this analysis.

The average volumetric spill rate for the period from 1977 to 1999 (0.1404 bbl/million bbl) is used to project future spills. Based on future projected throughput of 7.02 billion bbl (Appendix A) over the ROW extension, the total spill volume (small spills) is estimated to be approximately (1000*0.1404*7.02) equal to 987 bbl, or 32.9 bbl/yr (see Table B-14). As expected, this is very small com-

Table B-14. *Annual and total volumes for marine spills less than 1,000 bbl by material spilled, spill rate, and projected future small spills.*

Year	Marine Transport Crude (bbl)	Product (bbl)	Total (bbl)	TAPS Annual Throughput (million bbl)	Volumetric Spill Rate (bbl/million bbl)
1977	12.02	0.41	12.43	112.30	0.1107
1978	3.91	0.49	4.40	397.01	0.0111
1979	50.44	0.50	50.94	467.78	0.1089
1980	19.46	1.08	20.54	554.93	0.0370
1981	2.04	0.71	2.75	556.07	0.0049
1982	27.61	0.07	27.68	591.14	0.0468
1983	1.51	1.07	2.58	600.68	0.0043
1984	61.33	0.02	61.35	608.84	0.1008
1985	2.22	19.66	21.88	649.89	0.0337
1986	133.24	6.16	139.39	665.44	0.2095
1987	29.24	6.95	36.19	716.66	0.0505
1988	144.34	11.11	155.45	744.11	0.2089
1989	178.29	18.26	196.56	688.06	0.2857
1990	12.81	42.96	55.77	654.55	0.0852
1991	11.07	697.79	708.86	665.17	1.0657
1992	68.81	137.03	205.83	639.36	0.3219
1993	19.41	14.78	34.18	591.22	0.0578
1994	1.05	3.98	5.03	579.32	0.0087
1995	0.00	7.15	7.15	555.94	0.0129
1996	11.17	20.78	31.95	525.51	0.0608
1997	2.21	4.73	6.94	487.10	0.0143
1998	2.12	1.08	3.20	440.50	0.0073
1999	0.00	0.45	0.45	267.00	0.0017
Subtotal	**794.29**	**997.22**	**1,791.52**	**12,758.58**	**0.1404**

Future Projections:

Quantity	Units	Value	Remarks
Volumetric spill rate	bbl/million bbl	0.1404	spills < 1,000 bbl
Total throughput	billion bbl	7.02	Appendix A
Projected spill volume	bbl	985.72	Multiplication
Years ROW	years	30.00	Proposed renewal
Average annual spill volume	bbl/yr	32.86	Division

pared to the projections for large spills (690 to 2,750 bbl/yr) and could be neglected for practical purposes.

B.8.3 Spill Volumes Based on Data Since 1990

As noted above, it may be appropriate to partition the spill data, at least for the marine transportation link, into two periods: (i) 1977 to 1989 and (ii) 1990 to 1999. This section summarizes the results of applying the above methodology to the 1990 to 1999 data.

Over the period from 1990 to 1999 the number of large (>1,000 bbl) marine transportation spills was only one, the *American Trader* crude oil spill, which occurred off the coast of California in 1990 when this single-hull vessel drifted over and was punctured by its own anchor when mooring. TAPS throughput over the period from 1990 to 1999 totaled 5.41 billion bbl, so the estimated number of large spills per billion bbl for this period was 0.18. Applying this rate to the estimated 7.02 billion bbl of TAPS throughput over the renewal period, 1.3 large spills (absent any adjustments) would be projected to occur. For comparison, basing the analysis on the entire 1977-1999 period results in 2.75 projected large spills (see Table B-13), absent any adjustments for other possible improvements. The probability of one or more large spills during the renewal period given that 1.3 are expected can be calculated from the Poisson distribution to be approximately 0.73, rather than the 0.94 value shown in Table B-13. If the future spill rate were reduced by a factor of four, as was done in the above computations, the probability of one or more large spills during the renewal period would be 0.28, rather than 0.50 as shown in Table B-13.

It is also necessary to estimate the expected volume of oil spilled per large spill based on data for the period 1990 to 1999. Estimating this quantity from the data alone is problematic, because there is only one sample, the *American Trader,* which spilled 9,458 bbl.

However, this data point is interesting, because many analysts (see selected quotations contained in Table B-15) believe that substantially less (and possibly no) oil would have spilled as a result of this accident if the *American Trader* had been equipped with a double hull. Indeed, coming as it did on the heels of the EVOS, the *American Trader* spill created significant political impetus for the passage of legislation (ultimately incorporated into OPA 90) mandating use of double hulls. This information is certainly relevant. It is more difficult to decide how to integrate this into the spills analysis based on 1990 to 1999 data. Were such an accident to occur in the future (assuming a double-hull), the spill volume would be quite small, and possibly zero — implying a zero rate for large spills. Alternatively, the presence of a double-hull might be reflected in the assumed spill volume given an accident, which would certainly be smaller than the 30,000 bbl estimate assumed above.

Because a large spill rate that is *exactly zero* is unrealistic and because basing an estimate of the expected volume spilled on only one data point creates an estimate of unknown precision, we do not base spill volume estimates upon data from 1990 to 1999. *However, this analysis certainly implies that the estimates based on the entire data set (Table B-13) — even when adjusted to reflect improvements — are conservative.*

B.9 Comparisons with Other Analyses

B.9.1 Det Norske Veritas et al. Analysis

Det Norske Veritas et al. (1996) completed a very comprehensive risk analysis of possible spills in PWS. A series of models was used to estimate the likelihood of various possible accidents (including collisions, powered grounding, drift grounding, structural failure, and fire and explosion) in various segments of PWS and environs. Accident probabilities were quantified as the expected number of accidents per year and the “return period” or mean number of years between accidents, which is numerically equal to the reciprocal of the number of accidents per year. Table B-16 (top) provides a summary of these probability estimates as of 1995. For all accidents considered as a group, the likelihood as determined from these models ranged from approximately 2.9 X 10^{-2} (corresponding to a return period of 34 years) to 5.6 X 10^{-2} (a return period of 18 years).

Each accident type differed with respect to the fraction of accidents with the potential for oil outflow and the ex-

Table B-15. *The* American Trader *crude spill; several comments on the protective effect of double hulls.*

Statement	Source
“If the American Trader had had a double bottom or hull, this accident wouldn’t have spilled any oil, it wouldn’t have made a blip in the news.”	Arthur McKenzie, former Exxon official and president of the Tanker Advisory Center in New York quoted in Rempel (1990)
“Rep. Dean A. Gallo…said, the Huntington Beach spill ‘would never have happened’ with his proposal [requiring double hulls or double bottoms almost immediately on all new tankers and a retrofitting program on all existing tankers] in force.”	Rep. Dean A. Gallo (R–NJ) quoted in Rempel (1990)
“…on an inspection of the spill site Thursday, Coast Guard Commandant Paul A. Yost, Jr., acknowledged that the American Trader probably…would have lost less oil if (it) would have had a double bottom.”	Rep. Dean A. Gallo (R–NJ) quoted in Rempel (1990)
“In that [i.e., the American Trader] case — a clear argument for double bottoms — the Coast Guard captain in charge of the cleanup was none other than [James] Card himself. ‘It makes you wonder,’ said Card, who attained the rank of Admiral shortly afterward.”	Nalder (1994), p. 216
“‘There is not all that much water out there,” he said, adding that a swell apparently lifted the tanker up as it attempted to moor and when it came down, ‘it hit the anchor,’ and punctured the hull.”	Stanford Schmidt, president of New York-based American Trading and Transportation Co., owner of the American Trader, as quoted in Churm (1990)

pected outflow given a release. Table B-16 also shows the estimates of the fraction of accidents of each type with the potential for oil outflow.

For each possible accident type, an oil outflow model was used to project spill volumes. Based on these inputs, it was possible to estimate the expected annual oil outflow associated with each accident type. When summed over all accident types, the projected average annual oil spill volume ranged from approximately 1,830 to 3,690 bbl/yr.

The analysis was conducted by an independent study group, provided with external input (e.g., the Regional Citizens Advisory Council), and peer-reviewed. For this reason, the DNV analysis should be considered authoritative. The oil spill estimates were based on conditions prevailing in 1995 and specific initiatives under consideration at that time. For example, throughputs will be different as will the composition of the tanker fleet. In 1995 only three tankers were equipped with double-hulls, another ten with double-bottoms or double-sides. After 2014, all tankers engaged in the ANS trade will have double hulls. The effects of this fleet change need to be included in the analysis.

The effect of throughput can be adjusted for by expressing the estimated annual spill volume in terms of a volumetric spill rate and using this spill rate, together with future production estimates, to project future spills. These calculations are made in Table B-16 (bottom). The resulting annual spill volume (averaged over the 30-year TAPS ROW renewal period) ranges from approximately 770 bbl/yr to 1,555 bbl/yr — a geometric mean value of 1,095 bbl/yr. Allowance for the protective effects of double hulls would lower these projections substantially.

Thus, the Det Norske Veritas analysis is broadly consis-

Table B-16. *Risk-related estimates developed by Det Norske Veritas et al. (1996).*

Accident type	Accident Frequency Statistical Accidents Per Year		Return Period (yrs)		Percent of Accident Type with Potential for Oil Outflow	Estimated Average Annual Oil Outflow for Outbound Tankers (bbl)	
	Lower	Upper	Lower	Upper		Lower	Upper
Collisions	1.60×10^{-02}	4.10×10^{-02}	24	63	26.00%	530.2	1,272.6
Powered Grounding	5.92×10^{-03}	7.20×10^{-03}	139	169	68.00%	353.5	912.0
Drift Grounding	4.60×10^{-03}	5.50×10^{-03}	182	217	69.00%	473.7	855.5
Structural Failure	1.54×10^{-03}	1.63×10^{-03}	615	648	95.00%	190.9	367.6
Fire and Explosion	9.40×10^{-04}	9.40×10^{-04}	1,064	1,064	100.00%	282.8	282.8
Total	**2.90×10^{-02}**	**5.63×10^{-02}**	**18**	**34**	**75.00%**	**1,831.1**	**3,690.5**
					Throughput basis (million bbl/day)	1.522	1.522
					Throughput basis (million bbl/yr)	555.5	555.5
					Volumetric spill rate (bbl/million bbl)	3.30	6.64

Notes:

- Fire and explosion calculated by one model only.
- Estimated annual outflow calculated from accident frequency using oil outflow model.
- Annual oil outflows calculated from original estimates in tons assuming 7.07 bbl/ton.
- Total annual oil outflow calculated as sum from all accident types, there are minor discrepancies from original totals presented in report.
- Figures shown are for outbound tankers, summed over seven subareas from Gulf of Alaska to Port Valdez, summed over all seasons.
- Calculations based on 1995 throughput of 1.522 million bbl/day.

Future Spill Projections Based on This Analysis:

Quantity	Units	Lower	Upper	Source	Note
Volumetric Spill Rate	bbl/million bbl	3.30	6.64	See above	Estimated volumetric spill rate based on system as it existed in 1995 as adjusted for throughput differences. Estimates do not reflect improvements post 1995 or phase-in of double-hull tankers.
Future Throughput	billion bbl	7.02	7.02	Appendix A	
Projected Spill Volume	bbl	23,139	46,636	Multiplication	
Duration of ROW Renewal	years	30	30	Proposal	
Annual Spill Rate	bbl/yr	771	1,555	Division	
Geometric Mean of Lower and Upper Estimates	bbl/yr	1,095			

tent with the spill volume projections — particularly those with an improvement factor of 4 — presented in this analysis. Moreover, the Det Norske Veritas analysis identified a number of risk management options (for training, bridge-manning levels, escort/response vessel positioning, speed limits on various segments of the route) that have ultimately been incorporated into the marine transportation system (APSC, 1999b). Taken together, these improvements would lower spill probabilities/volumes beneath those summarized in Table B-16.

B.9.2 MMS Analysis

Hart Crowser Inc. (2000) recently conducted an oil spill analysis for the ANS and TAPS on behalf of the U.S. Minerals Management Service. This study was based on a data set that included spills greater than 100 bbl from activities associated with oil production and transportation in Alaska and Arctic Canada. Hart Crowser concluded that the data collected from Alaska operations for the years 1980 onward were the most reliable and pertinent, and statistical analyses were performed on that data set. They estimated that between 52 gallons (1.2 bbl) and 66 gallons (1.6 bbl) of oil would be spilled per million barrels of oil produced and transported.

Although the data set used by Hart Crowser differed from that used in this analysis, the projected spill volumes for the period from 2004 to 2034 are similar. Based on future production and transportation of 7 billion barrels of oil over the renewal period, the Hart Crowser spill rates from E&P and pipeline operations would result in a projected spill volume ranging from 8,700 to 11,000 barrels. Table B-9 shows total spill volume estimates of 7,851 bbl (sum of E&P and Pipeline volumes for 1977 to 1999 data set) and 23,250 barrels (sum of E&P and Pipeline volumes for 1990 to 1999 data set) for these same two segments over the renewal period.

Table B-17 compares actual spill rates with those projected in the original TAPS EIS, the Det Norske Veritas at al. analysis, and the Hart Crowser study.

B.10 Spill Projections for the No-Action Alternative

Selection of the no-action alternative would eliminate spills that occur at the North Slope, pipeline spills, and VMT spills. (*Displace* is a more accurate term than *eliminate* because the United States would import additional oil to make up for the shortfall caused by shutting down TAPS. E&P and pipeline spills would be displaced to the country of origin of U.S. crude oil imports.) Additionally, there would be some product spills during the period of dismantling, removal, and restoration of the North Slope production facilities, pipeline, and VMT.

Opting for the no-action alternative would not eliminate tanker crude oil spills, because additional oil would be imported to U.S. refineries to compensate for the lack of ANS crude. To be sure, no further spills associated with TAPS would occur at Valdez. *However, spills at West Coast ports would not be affected.*

B.11 Estimates

Tables B-18 and B-19 summarize the above quantitative analysis and presents estimates of the future spill volumes associated with the recommended action alternative. These

Table B-17. *Comparison of spill rates by Operations segment (bbl/million bbl throughput)*

Segment	TAPS EIS Forecast (a)	Actual Operations 1977-99 (b)	Forecast for 2004-2034 (b): Based on 1977-99 data	Forecast for 2004-2034 (b): Based on 1990-99 data	DNV Forecast (c)	MMS Forecast (d)
E&P (ANS)	*	0.9	0.9	0.7	*	*
Pipeline	*	2.5	2.5	0.4	*	*
E&P + Pipeline	*	3.4	3.4	1.1	*	1.2 - 1.6
VMT	1.5	0.3	0.3	0.1	*	*
Marine	192	22	3.0(e) - 22.0	2	3.3 - 6.6	*

*Not forecast in study.
(a) Normalized from BLM (1972) (based on estimated spill rates of 3 bbl/day for transfers at VMT and 384 bbl/day for marine spills at a throughput of 2 million bbl/day).
(b) From this report, Table B-9.
(c) From Det Norske Veritas et al. (1996) risk assessment of marine operations only (see Table B-16, this report).
(d) From Hart Crowser Inc. (2000); study addressed potential spills from E&P and TAPS combined; VMT was not included.
(e) Includes expected improvements attributable to SERVS and double-hull tankers (see Table B-18, this report).

Table B-18. *Estimates of future Operations oil spills based on historical data only.*

Segment	Total Volume 2004-2034 (bbl)	Average per Year 2004-2034 (bbl)	Remarks
E&P	6,050	202	Based on average volumetric spill rate and projected throughput
Pipeline	17,200	573	Based on average volumetric spill rate and projected throughput
VMT	2,270	76	Based on average volumetric spill rate and projected throughput
Marine Transportation	154,400	5,147	Based on average volumetric spill rate and projected throughput
TOTAL	179,920	5,998	Sum of above

Table B-19. *Estimate of future marine transportation spills based on allowance for mitigating measures.*

Segment	Total Volume 2004-2034 (bbl)	Average per Year 2004-2034 (bbl)	Remarks
Marine Transportation	20,700 to 82,500	690 to 2,750	Based on analysis of large (>1,000 bbl) spills, range results from use of various improvement factors
	986	33	Based on average volumetric flow rate (small spills) and projected throughput
Subtotal	21,686 to 83,486	723 to 2,783	Sum of small and large spill estimates
TOTAL ALL SEGMENTS	47,206 to 109,006	1,573 to 3,634	Sum of marine transportation and other segments taken from Table B-17 above

are partitioned into estimates based solely on historical data (Table B-18) and those based on historical data and an allowance for the effects of preventative measures implemented in recent years (Table B-19).

Based solely on historical data, the average annual spill volume over the ROW renewal period for all Operations segments is approximately 6,000 bbl/yr. The marine transportation segment accounts for nearly 74 percent of this annual total.

The estimate of 6,000 bbl/yr does not reflect any allowance for improvements made to the system. As noted, the cost of these improvements has been substantial. SERVS alone costs $60 million annually. Three new Millennium-class double-hull tankers, each costing approximately $166 million, are already on order, and six other tankers will be required in the future to replace existing single-hull tankers under terms of OPA 90. The total cost ($ billions in money of the day) of these two improvements alone over the 30-year renewal period is nearly $3.3 billion. To base spill estimates solely upon past history is to assume that these costly improvements have no identifiable benefits.

A second set of spill estimates is provided, which is based on historical experience for E&P, pipeline, VMT, and improved performance for the marine transportation segment. These estimates are expressed as a range, based on literature estimates of the benefits of new technology. For all Operations segments, the estimated annual spill totals over the ROW renewal period range from approximately 1,600 to 3,600 bbl. These estimates represent the average annual total based on conservative assumptions (e.g., no improvement to E&P, pipeline, or VMT spill rates). Spill totals have been highly variable in the past. In particular, this analysis indicates that there is a probability, ranging from 50 to 94 percent, that there will be one or more large spills throughout the duration of the ROW renewal period. The 50 percent probability is based on historical data for the entire period of TAPS operations, adjusted to reflect the effects of improvements made since 1990, whereas the 94 percent estimate assumes no improvement. The facts brought out in the discussion of these estimates — and the analysis based on data for the period 1990 to 1999 — indicate that even the lower probability is likely to be a conservative estimate. The upper value, which assumes no real improvement over historical experience, is virtually certain to be highly conservative. The expected spill volume given that a large (>1,000 bbl) spill occurs, 30,000 bbl, is based on MMS (1996) analysis. Although this estimate is smaller than actually observed over the operating history of the marine transportation system, it too is likely to be conservative.

Choice of the no-action alternative will lower the estimated spill volume *in Alaska* (because TAPS, VMT, and the associated ANS fields will be shut down), but will only displace these spills to other production and distribution systems — perhaps with fewer safeguards. The Cook Inlet refinery, for example, will likely continue to operate, and does not have a SERVS fleet to escort tankers. Other Alaska refineries at North Pole and Valdez would either be shut in or have to import crude oil by other modes of transportation. If the refineries are shut in, refined products would have to imported to supply areas previously serviced by these refineries. Spills would continue under any scenario. Moreover, spills occurring at U.S. destination ports (e.g., refineries in Hawaii or the West Coast) would not be eliminated. As shown in Table B-4, three of five of the largest marine spills for ANS tankers were at destination ports.

References - Appendix B

Aitchison, J., and J.A.C. Brown. 1969. The Lognormal Distribution with Special Reference to its Uses in Economics. Cambridge University Press, Cambridge, England.

Amstutz, D.E., and W.B. Samuels. 1984. Offshore Oil Spills: Analysis of Risks. *Marine Environmental Research.* 13:303–319.

Anderson, C.M., and R.P. LaBelle. 1990. Update of Occurrence Rates for Accidental Oil Spills on the U.S. Outer Continental Shelf. *Oil and Chemical Pollution,* 6(21):21–35.

Anderson, C.M., and R.P. LaBelle. 1994. Comparative Occurrence Rates for Offshore Oil Spills. *Spill Science and Technology Bulletin,* 1(2):131-141.

APSC. 1999a. Trans Alaska Pipeline System Facts. Alyeska Pipeline Service Company. Anchorage, Alaska.

APSC. 1999b. Prince William Sound Tanker Spill Prevention and Response Plan. Second Edition, Revision O. Alyeska Pipeline Service Company. Anchorage, Alaska.

APSC. 1999c. Spill Prevention and Response in Alaska's Prince William Sound. Alyeska Pipeline Service Company. Anchorage, Alaska.

Baumol, W. J. 1982. Economics Principles and Policy, 2nd ed. Harcourt Brace Jovanovich, Inc., New York, New York.

BLM. 1972. Final Environmental Impact Statement, Proposed Trans-Alaska Pipeline. Bureau of Land Management, Alaska Office, Anchorage, Alaska.

BLM and MMS. 1998. Northeast National Petroleum Reserve-Alaska, Final Integrated Activity Plan/Environmental Impact Statement. Volumes 1 and 2. Prepared by US Department of Interior, Bureau of Land Management and Minerals Management Service, Anchorage, Alaska. Government Printing Office, Washington, D.C.

Churm, S. R. 1990. Major Tanker Spill Threatens O.C. Coast. *Los Angeles Times,* Orange County Edition, Pg. A–1. February 8, 1990.

Clark, P.J., and F.C. Evans. 1954. Distance to Nearest Neighbors as a Measure of Spatial Relationships in Populations. *Ecology.* 35:445–453.

Clark, M. 1999. Oil critics demand safer tankers. *Anchorage Daily News.* Final edition., p B1, March 22, 1999.

Clarke, R.D. 1946. An Application of the Poisson Distribution. *Journal of the Institute of Actuaries.* 72:48 *et seq*.

CONCAWE. 1998. Western European Cross-country Oil Pipelines 25-year Performance Statistics. Conservation of Clean Air and Water in Europe. Brussels, Belgium.

Davidson, A. 1990. In the Wake of the Exxon Valdez, The Devastating Impact of the Alaska Oil Spill. Sierra Club Books, San Francisco, California.

Det Norske Veritas, George Washington University, Rensselaer Polytechnic Institute, and LeMoyne College. 1996. Prince William Sound, Alaska Risk Assessment Study, Final Report.

Duncan, A.J. 1965. Quality Control and Industrial Statistics. Richard D. Irwin, Inc., Homewood, Illinois.

Elfring, F.J., Lt. Commander. 2000. Automatic identification system. From web site: www.uscg.mil/vtm/briefs/aiselfring/index.htm.

Federal Grant. 1974. Agreement and Grant of Right-of-Way for Trans-Alaska Pipeline Between The United States of America and Amerada Hess Corporation, ARCO Pipe Line Company, Exxon Pipeline Company, Mobil Alaska Pipeline Company, Phillips Petroleum Company, Sohio Pipe Line Company, and Union Alaska Pipeline Company.

Fineberg, R.A. 1997. Pipeline in Peril, Alaska at Risk on the 20th Anniversary of the Trans-Alaska Pipeline, an Update of Events on the Troubled Alaska Pipeline since September 1996. A report to the Alaska Forum for Environmental Responsibility, Ester, Alaska.

Fry, T.C. 1965. Probability and its Engineering Uses. D. Van Nostrand Co., Princeton, New Jersey.

GAO. 1990. Energy Security, Impacts of Lifting Alaskan North Slope Oil Exports Ban. Report to the Chairman, Subcommittee on Energy and Power, Committee on Energy and Commerce, House of Representatives. GAO/RCED–91–21. U.S. General Accounting Office. Washington, D.C.

GAO. 1999. Alaskan North Slope Oil: Limited Effects of Lifting Export Ban on Oil and Shipping Industries and Consumers. GAO/RCED–99–191. US General Accounting Office.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold Company, New York, New York.

Hart Crowser Inc. 2000. Estimation of Oil Spill Risk from Alaska North Slope, Trans-Alaska Pipeline, and Arctic Canada Oil Spill Data Sets. Prepared for Minerals Management Service, Anchorage, Alaska. April 2000.

Johnson, N.L., and S. Kotz. 1970. Distributions in Statistics; Continuous Univariate Distributions. 2 volumes. John Wiley & Sons, New York, New York.

Kendall, M.G., and A. Stuart. 1963. The Advanced Theory of Statistics. 3 volumes, 2nd Ed. Hafner, New York, NY.

King, L.J. 1969. Statistical Analysis in Geography. Prentice-Hall, Englewood Cliffs, New Jersey.

Kizzia, T. 1990. Spill-shy BP Avoids Inlet Refinery. *Anchorage Daily News.* Pg. C1. February 10, 1990.

Koch, G.S., and R.F. Link. 1971. Statistical Analysis of Geological Data. Dover Publications, Inc., New York, New York.

Little, R. 1999. U.S. Department of Transportation, Office of Pipeline Safety, Pipeline Statistics. Personal communication.

Mallary, C.R. 1998. A Review of Alaska North Slope Blowouts, 1974-1997. Shared Services Drilling.

Maxim, L.D., J.N. Allshouse, W.P. Kelly, T. Walters, and R. Waugh. 1997. A Multiyear Workplace-Monitoring Program for Refractory Ceramic Fibers: Findings and Conclusions. *Regulatory Toxicology and Pharmacology,* 26:156–171.

Maxim, L.D., W.P. Kelly, T. Walters, and R. Waugh. 1994. A Multiyear Workplace-Monitoring Program for Refractory Ceramic Fibers. *Regulatory Toxicology and Pharmacology,* 20, S200–S215.

MMS. 1987a. Alaska Outer Continental Shelf Beaufort Sea Sale 97 Final EIS. OCS/EIS, MMS 87-0069. 2 volumes. Minerals Management Service, Alaska OCS Region. Anchorage, Alaska.

MMS. 1987b. Alaska Outer Continental Shelf Chukchi Sea Oil & Gas Lease Sale 109 Final EIS. 2 volumes. OCS EIS/EA MMS 87–0110. Minerals Management Service. Anchorage, Alaska.

MMS. 1990. Alaska Outer Continental Shelf Beaufort Sea Planning Area Oil and Gas Lease Sale 124 Final EIS. OCS EIS/EA MMS 90–063. Minerals Management Service. Anchorage, Alaska.

MMS. 1996. Alaska Outer Continental Shelf Beaufort Sea Planning Area Oil and Gas Lease Sale 144 Final EIS. OCS EIS/EA MMS 96–0012. Minerals Management Service, Alaska OCS Region. Anchorage, Alaska.

Nalder, E. 1994. Tankers Full of Trouble; the Perilous Journey of Alaskan Crude. Grove Press, New York.

NRC. 1991. Tanker Spills: Prevention by Design. National Research Council, Committee on Tank Vessel Design, Marine Board, Commission on Engineering and Technical Systems. National Academy Press, Washington, D.C.

NRC. 1994. Minding the Helm, Marine Navigation and Piloting. National Research Council, Committee on Advances in Navigation and Piloting, Marine Board Commission on Engineering and Technical Systems. National Academy Press, Washington, D.C.

NRC. 1998. Double-Hull Tanker Legislation, An Assessment of the Oil Pollution Act of 1990. National Research Council, Marine Board, Commission on Engineering and Technical Systems. National Academy Press, Washington, D.C.

NTSB. 1990. Marine Accident Report, Grounding of the U.S. Tankship *Exxon Valdez* on Bligh Reef, Prince William Sound, near Valdez, Alaska, March 24, 1989. National Transportation Safety Board, Bureau of Accident Investigation, U.S. Department of Commerce, National Technical Information Service, PB90916405, Washington, D.C.

Parzen, E. 1960. Modern Probability Theory and its Applications. John Wiley & Sons, Inc., New York, New York.

Petterson, B. 2000. The Implication of AIS–Automatic Identification System (Transponder) on Ships and Shore. From web site: www.gpc.se/Tokyo/AIS_w6.htm.

Queeney, T. 2000. High-accuracy GPS Now Available to all Mariners. *Professional Mariner.* 50:4–6.

Rappaport, S.M. 1991. Assessment of Long-term Exposures to Toxic Substances in Air. *Annals of Occupational Hygiene.* 39(4)**:**466–495.

Rempel, W.C. 1990. Incident Fuels the Drive for Double Hulls. *Los Angeles Times*, Home Edition, Part A, Pg. A-1. February 9, 1990.

Samuelson, P.A. 1980. Economics. 4th Ed. McGraw-Hill Book Company, New York, New York.

Shooman, M.L. 1968. Probabilistic Reliability: An Engineering Approach. McGraw-Hill Book Company, New York, New York.

Skalle, P., and A. Podio. 1998. Trends Extracted from 1200 Gulf Coast Blowouts During 1960–1996. *World Oil*.

Smith, R.A., J.R. Slack, T. Wyant, and K.J. Lanfear. 1982. The Oilspill Risk Analysis Model of the U.S. Geological Survey. Geological Survey Professional Paper 1227, U.S. Department of the Interior, Washington, D.C.

USACE. 1997. Alpine Development Project: Environmental Evaluation Document. U.S. Army Corps of Engineers, Alaska District. Anchorage, Alaska.

USACE. 1999. Final Environmental Impact Statement, Beaufort Sea Oil and Gas Development/ Northstar Project. 17298-027-220. 4 Volumes. U.S. Army Corps of Engineers, Alaska District. Anchorage, Alaska.

USCG. 1997a. Oil Pollution Research and Technology Plan; Interagency Coordinating Committee on Oil Pollution Research. U.S. Coast Guard. From web site: http://www.uscg.mil/hq/g%2Dm/nmc/gendoc/coop/coop.htm.

USCG. 1997b. Position Statement on Automatic Identification Systems (AIS). COMPTNOTE 16630. U.S. Coast Guard, Office of Vessel Traffic Management.

USCG. 2000a. DGPS Sites and Coverage Diagrams. U.S. Coast Guard. From web site: www.navcen.uscg.mil.

USCG. 2000b. Universal Shipborne Automatic Identification System (AIS) Transponder. U.S. Coast Guard. From web site: www.navcen.uscg.mil/marcomms/ais.htm.

USCG and DOT. 1993. T/V *Exxon Valdez* Oil Spill, Federal On-scene Coordinator's Report. Volume 1. Prepared for National Response Team (NRT) and Alaska Regional Response Team (RRT). U.S. Coast Guard and U.S. Department of Transportation. Washington, D.C.

Wadsworth, G.P., and J.G. Bryan. 1960. Introduction to Probability and Random Variables. McGraw-Hill Book Company, New York, New York.

Wallis, W.A. 1936. The Poisson Distribution and the Supreme Court. *Journal of the American Statistical Association.* 31:376–380.

Whitney, D. 1990. Expert lauds safety of double hull ships, lawmakers try to create spill bill compromise. *Anchorage Daily News*, final edition, p. C1, May 25, 1990.

Whitney, D. 1999. Global success of Oil Pollution Act praised. *Anchorage Daily News*, final edition, p. B1, March 25, 1999.